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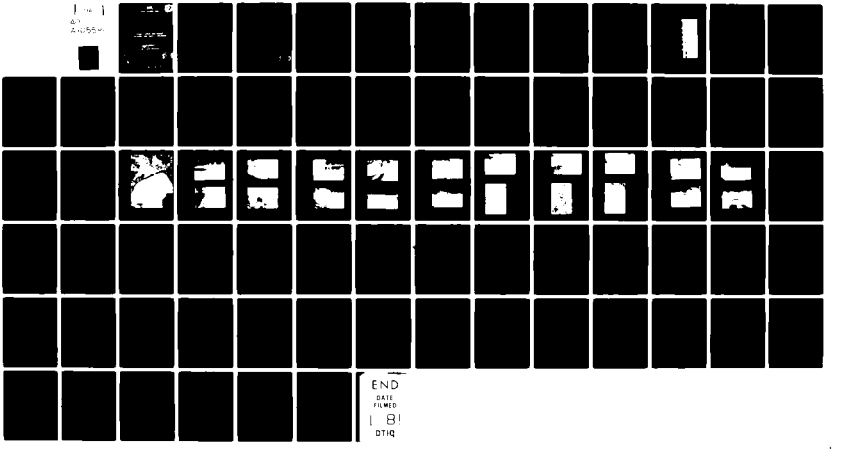

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SANTA FE COUNTRY CLUB DAM
LINN COUNTY, MISSOURI
MO 10765

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER [illegible]

FOR: STATE OF MISSOURI

MAY, 1980

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1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A105581	3. RECIPIENT'S CATALOG NUMBER
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	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Hoskins-Western-Sonderegger, Inc.	8. CONTRACT OR GRANT NUMBER(s) DACW43-80-C-0071
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	12. REPORT DATE May 1980
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19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

SANTA FE COUNTRY CLUB DAM
LINN COUNTY, MISSOURI
MISSOURI INVENTORY NO. MO 10765

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY

HOSKINS-WESTERN-SONDEREGGER, INC.
CONSULTING ENGINEERS
LINCOLN, NEBRASKA

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

MAY, 1980

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Santa Fe Country Club Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Santa Fe Country Club Dam (MO 10765).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

a. Spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the dam.

b. Overtopping of the dam could result in failure of the dam.

c. Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED
Chief, Engineering Division — 24 SEP 1980 (Date)

APPROVED BY: SIGNED
Colonel, CE, District Engineer — 25 SEP 1980 (Date)

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM
ASSESSMENT SUMMARY

Name of Dam	Santa Fe Country Club Dam
State Located	Missouri
County Located	Linn County
Stream	Tributary to East Yellow Creek
Date of Inspection	May 6, 1980

Santa Fe Country Club Dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. The purpose of the inspection was to make an assessment of the general conditions of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers.

Santa Fe Country Club Dam has a height of twenty-five (25) feet and a storage capacity at the minimum top elevation of the dam of one hundred and sixty (160) acre-feet. In accordance with the guidelines, a small size dam has a height greater than or equal to twenty-five (25) feet, but less than forty (40) feet and a storage capacity greater than or equal to fifty (50) acre-feet, but less than one thousand (1,000) acre-feet. The size classification is determined by either the storage capacity or height, whichever gives the larger size category. Santa Fe Country Club Dam is classified as a small size dam.

In accordance with the guidelines and based on visual observation, the dam is classified as having a high potential for damage and loss of life. Failure would threaten life and property. The estimated damage zone extends approximately nine-tenths (0.9) of a mile downstream of the dam. Within the damage zone are one (1) house trailer at two-tenths (0.2) of a mile downstream; one (1) dwelling at four-tenths (0.4) of a mile downstream; Highway JJ immediately north of the dwelling; one (1) house trailer at one-half (½) mile downstream; and the Marceline sewage disposal plant at nine-tenths (0.9) of a mile downstream.

Our inspection and evaluation indicates that the spillway does not meet the criteria set forth in the recommended guidelines for a small dam having a high hazard potential. Considering the small volume of water impounded, the wide flood plain and the downstream hazards, one-half (½) of the Probable Maximum Flood is the appropriate spillway design flood.

The spillway will pass the 100-year flood (1% probability flood, a flood having a 1% chance of being exceeded in any year) without overtopping the dam. The spillway will pass 20% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

No design data were available for this dam. Based on the observations made during the field inspection of the dam, the following remedial measures should be performed under the guidance of a professional engineer experienced in the design and construction of dams:

a. Alternatives.

(1) The spillway size and/or the height of dam should be increased to pass 50 percent of the Probable Maximum Flood without overtopping the dam.

b. Operation and Maintenance Procedures.

(1) Additional information should be obtained on the topographic characteristics of the reservoir area to determine the overtopping potential of the dam and abutment areas. The present low areas on each end of the dam could be developed as emergency spillways, if required.

(2) Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" should be performed and made a matter of record.

(3) The installation of riprap (concrete rubble or other) on the upstream slope should be completed.

(4) Trees and brush should be removed from the embankment slopes and crestlines and measures taken to prevent their recurrence.

(5) The downstream slope should be seeded with adapted grasses and legumes following clearing of brush and small trees.

(6) The spillway channel should be cleared of brush and trees for at least 200 feet downstream from the crest, and measures taken to prevent their recurrence. The spillway exit channel from the roadway to the channel bottom should be

stabilized with large riprap or other material after the channel is cleared.

Rey S. Decker
E-3703

Gordon Jamison

Garold Ulmer
E-19246

H. P. Hoskins
Harold P. Hoskins, Chairman of the Board
Hoskins-Western-Sonderegger, Inc.
E-8696

FORM 1

PHOTO NO. 1 - OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SANTA FE COUNTRY CLUB DAM - MO 10765
LINN COUNTY, MISSOURI

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Santa Fe Country Club Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams, "Appendix D to "Report of the Chief of Engineers on the National Program of Inspection of Dams,"dated May, 1975, and published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is a small earth structure approximately 680 feet in length and 25 feet in height. The maximum water storage at the minimum top elevation of the dam is 160 acre-feet. This site is located in the dissected till plains area of the Central Lowlands Physiographic Region. Materials in the area generally consist of a thin mantle of loess overlying glacial till with stratified shales, sandstones, and limestones at undetermined depths.

(2) The uncontrolled spillway is excavated through the right abutment and consists of a concrete sill 40 feet in length outletting into an earthen channel which discharges into an old stream channel near the right abutment toe of the dam.

(3) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located within the corporate limits of Marceline, Missouri, in the southeastern part of Linn County as shown on Plate A-2. The dam is shown on Plate A-1 in the N 1/2 of Section 31, T 57 N, R 18 W. The lake formed behind the dam is shown in the N 1/2 and the S 1/2 of Section 31, T 57 N, R 18 W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Santa Fe Country Club Dam has a height of 25 feet and a storage capacity at the minimum top elevation of the dam of 160 acre-feet. This dam is classified as a small size dam. A small size dam has a height greater than or equal to 25 feet, but less than 40 feet, and a storage capacity greater than or equal to 50 acre-feet, but less than 1,000 acre-feet. The size classification is determined by either the storage capacity or height, whichever gives the larger size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph 1.1c above. Based on referenced guidelines and visual observation, this dam is in the High Hazard Classification. The estimated damage zone extends about nine-tenths (0.9) of a mile downstream from the dam. Within the damage zone are one (1) house trailer at two-tenths (0.2) of a mile downstream; one (1) dwelling at four-tenths (0.4) of a mile downstream; Highway JJ immediately north of the dwelling; one (1) house trailer at one-half (½) mile downstream; and the Marceline sewage disposal plant at nine-tenths (0.9) of a mile downstream.

e. Ownership. The dam is owned by the City of Marceline, 116 North Kansas, Marceline, Missouri 64658.

f. Purpose of Dam. The dam impounds a recreational lake covering about 16 acres and containing about 122 acre feet of water.

g. Design and Construction History. It was reported by Mr. L. J. Hayes, Marceline City employee, that the dam was constructed about 1910 to supply water for the Santa Fe Railroad. No other information was available.

h. Normal Operating Procedure. At the present time there are no operating procedures for this structure. The level of the lake is dependent upon precipitation, storm run-off, infiltration and evaporation. Mr. Hayes reported that prior to about 1976, the lake level was drawn down each year to control the growth of algae. This procedure was discontinued when they started using chemicals to control the algae.

1.3 PERTINENT DATA

a. Drainage Area. 170 acres (0.266 square miles)

b. Discharge At Damsite.

(1) All discharges at the damsite are through an uncontrolled earth channel with a 40 foot wide concrete sill and a 6 inch diameter vitrified clay tile drawdown pipe.

(2) Estimated maximum flood - unknown.

(3) The spillway capacity varies from 0 c.f.s. at the spillway crest (elevation 827.2 feet) to 140 c.f.s. at the minimum top of dam (elevation 829.2 feet).

(4) Total spillway capacity at the minimum top of dam is 140 c.f.s. ±.

c. Elevations. (Feet above M.S.L.)

(1) Top of dam - 830 feet ± (829.2 feet-minimum top of dam).
(2) Spillway Crest & Normal Pool - 827.2 feet.
(3) Observed pool - 827.0
(4) Maximum experienced pool - 828.5 feet
(5) Streambed at centerline - 805 feet ±
(6) Maximum tailwater - unknown

d. Reservoir. Length (feet) of pool.

(1) Top of dam (minimum) - 1500 ±
(2) Spillway crest - 1400 ±

e. Storage (Acre-feet).

(1) Top of dam - 160 ±
(2) Principal spillway crest and Normal pool and Observed pool - 122 ±.
(3) Maximum experienced pool - 145 ±.

f. Reservoir Surface (Acres).

(1) Top of dam - 19 ±.
(2) Principal spillway crest & Normal pool & Observed Pool - 16 ±.
(3) Maximum experienced Pool - 18 ±.

g. Dam.

(1) Type - Earth fill
(2) Length - 680 ±

(3) Height - 25 feet ±
(4) Top width - 18 feet ±
(5) Side slopes
    (a) Downstream - 1V on 2.2H (measured)
    (b) Upstream - 1V on 1.75H (measured)
(6) Zoning - unknown
(7) Impervious core - unknown
(8) Cutoff - unknown
(9) Grout curtain - unknown
(10) Wave protection - scattered concrete rubble

h. Diversion Channel and Regulating Tunnel. None.

i. Spillway.

(1) Principal (only)

(a) Type - excavated earth channel.
(b) Control section-concrete sill, 40 feet wide.
(c) Crest elevation - 827.2.
(d) Upstream Channel - none, reservoir encroaches upon sill.
(e) Downstream Channel - Natural earth

j. Regulating Outlets. 6-inch diameter vitrified clay tile with valve on downstream end located under the concrete sill control section.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available for this dam.

2.2 CONSTRUCTION

No construction data were available. It was reported by Mr. L. J. Hayes, City employee, that the dam was constructed by the Santa Fe Railroad about 1910, to provide a water supply for the railroad. According to Mr. Hayes, the original spillway consisted of a cut through the right abutment. The present concrete sill control section was constructed in 1976.

2.3 OPERATION

No data were available on spillway operation. Mr. Hayes reported that the spillway operates several times each year and that the maximum depth of flow in the spillway was about 1.5 feet. It was also reported by Mr. Hayes that, prior to about 1976, the drawdown facility was opened each summer to lower the lake level 3 to 4 feet in order to treat and control the growth of algae (moss). This procedure was discontinued when the city began using chemicals to control the moss, and the drawdown has not been operated since then.

2.4 EVALUATION

a. Availability. No data were available.

b. Adequacy. The field surveys and visual observation presented herein are considered adequate to support the conclusions of this report. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the Santa Fe Country Club Dam was made on May 6, 1980. Engineers from Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska making the inspection were: Rey S. Decker, Geotechnical, Gordon Jamison & Garold G. Ulmer, Hydrology. Mr. L. J. Hayes, Marceline city employee, accompanied the inspection team.

b. Dam.

(1) Geology and Soils (abutment & embankment). Upland soils in the area consist of 4 to 8 feet of loess (CL-ML) overlying Kansan age glacial drift (CL-CH). Materials in the dam consist of lean clay (CL). Glacial till is exposed in the spillway channel downstream from the right abutment trough and in a gully downstream from the left abutment trough. Bedrock was not exposed in the site. It probably consists of shale, sandstone, limestone and coal beds belonging to the Marmaton group, Desmonsian series of the Pennsylvanian system (waste from an old coal mine is exposed about 0.6 mile downstream).

(2) Upstream Slope. The upstream slope has suffered severe wave erosion, and the earth fill is nearly vertical in several locations. Within the past two years several loads of broken concrete rubble have been loose dumped along the upstream face. Trees and brush pretty well cover the upstream slope except in those areas where the concrete rubble has been dumped. Photo No. 11 shows the upstream face of the dam.

(3) Crest. The crest serves as a roadway with practically no vegetation. Large trees and brush grow along both upstream and downstream crest lines as shown in Photo No. 8. Elevations along the crest are quite uniform except at each end of the dam. The abutment area on the left end is about 1 foot lower than the crest on the right end of the dam (see Plate C-2). There is an area extending from about station 8+00 to the spillway (8+80±) that is 1 to 1.5 feet lower than the nominal crest elevation. Some drying cracks were noted on the crest, but no other irregularities were evident.

(4) Downstream slope. Most of the downstream slope is densely overgrown with trees (up to 30-inch diameter) and brush as shown in Photo No. 10. Clearing of brush and trees on the downstream slope has begun on the left end of the dam

as shown in Photo No. 12. There is evidence of seepage (crayfish holes and mud daubs, dried moss, etc.) along the toe of the dam extending from about station 3+00 to 7+00. There was no free water along the toe at the time of inspection. Photos No. 13 and 14 show indications of seepage along the toe. There was no indication of seepage on the downstream slope of the dam. Vegetation was so dense on most of the slope that it was not possible to observe the presence of slumps or abnormal deformations. However, there did not appear to be any excessive erosion on the slope. No rodent holes were observed during the inspection.

c. Appurtenant Structures.

(1) Spillway. The spillway outlet channel is overgrown with trees and brush as shown in Photo No. 4. One area along the left bank of the outlet channel about 45 feet downstream from station 8+30 is badly eroded (see Photo Nos. 16, 17 and 18). Seepage effluent was observed in the channel bottom downstream from about station 7+00 to 7+50. Total seepage discharge was estimated at 0.1 gpm. All seepage was clear, and no boils were observed. The seepage in the channel is shown in Photo No. 15. The concrete sill (control structure) appeared to be in good condition. The concrete control section is shown in Photo No. 3.

(2) Drawdown Facilities. A 6-inch diameter vitrified clay tile, with valve on the lower end, is located near the centerline of the spillway. According to Mr. Hayes, this drawdown pipe extends about 150 feet into the reservoir. It outlets about 30 feet downstream from the spillway control sill. The drawdown facility has not been operated since about 1976. No seepage was observed from the discharge pipe nor anywhere in the area of the pipe. The drawdown facility is shown on Plate C-1 and in Photo No. 5.

d. Reservoir Area. The area around the reservoir is well grassed, and no significant erosion was observed around the water line.

e. Downstream Channel. The channel downstream from the dam and spillway is poorly defined. The channel and the entire flood plain is heavily overgrown with trees and brush.

3.2 EVALUATION

The stability of the dam appears to be adequate from the standpoint of shear strength and seepage. The heavy growth of trees and brush on the crest lines and the downstream slope should be removed under the guidance of a professional engineer experienced in the design and construction of dams. Continued expansion of the root systems of the trees can lead to seepage and piping which are detrimental

to the structural stability of the dam. Erosion of the upstream face of the dam could cause serious potential of failure if not brought under control. It should be noted that the city is working to alleviate the problem of erosion of the upstream slope as well as the problem of tree and bush growth on the downstream slope.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The pool level is controlled by rainfall, infiltration, evaporation, and the capacity of the uncontrolled spillway. Prior to about 1976, the pool level was drawn down each year to control and treat the growth of algae in the reservoir. This practice was discontinued when chemical treatment for algae was initiated.

4.2 MAINTENANCE OF DAM

Very little, if any, maintenance work was done on the dam until about 1978. At this time the City of Marceline began riprapping the upstream face and clearing the downstream slope. Mr. Tom Stanley, City Engineer, said that this work will continue as time and money are available.

4.3 MAINTENANCE OF OPERATING FACILITIES

Mr. Hayes reported that the drawdown facility is operational but has not been used for about 4 years.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system in effect for this dam.

4.5 EVALUATION

The lack of maintenance during the years prior to 1978 is the principal reason for the problems existing at the present time; namely the heavy growth of trees and brush on the dam and in the downstream channel of the spillway as well as the erosion of the upstream face. Maintenance work is being done at the present time to alleviate these problems.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were found for this dam.

b. Experience Data. The drainage area, reservoir surface area, and elevation-storage data were developed from the USGS Marceline, Missouri 7.5 minute topographic quadrangle map. The hydraulic computations for the spillway and dam overtopping discharge ratings were based on data collected in the field at the time of the field inspection.

c. Visual Observations.

(1) The concrete sill of the spillway appears to be in good condition; however, the spillway exit channel is badly overgrown with trees and shrubs.

(2) There is severe erosion in the left bank of the exit channel (See Photos 16, 17 and 18) located in the right abutment. This erosion could encroach upon the dam embankment.

(3) The outlet and valve for a 6-inch drawdown pipe is located in the spillway exit channel. It was reported by Mr. Hayes, employee of the City of Marceline, to be operable.

d. Overtopping Potential. The spillway is too small to pass one-half of the probable maximum flood with overtopping. The spillway will pass almost 20 percent of the probable maximum flood and the one percent probability flood without overtopping. Most of the overtopping flood will pass through the low areas at each end of the dam rather than over the embankment. The results of the routings through the dam are tabulated in regards to the following conditions.

Frequency	Inflow Discharge c.f.s.	Outflow Discharge c.f.s.	Maximum Pool Elevation	Maximum Depth Over Dam Feet	Duration Over Top Hours
1/2 PMF	1440	1060	830.4	1.2	5-
PMF	2880	2570	830.9	1.7	7-
0.20 PMF	580	150	829.3	0.1	1

*Minmum Top of Dam Elevation - 829.2.

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and a small size. Therefore, 1/2 PMF to PMF is the test for the adequacy of the dam and its spillway.

The estimated damage zone is described in Paragraph 1.2d in this report.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation. The embankment appears to be structurally stable from the standpoint of shear strength and seepage. The amount and extent of erosion that might be caused by high discharges around the ends of the dam are not known. Uncontrolled growth of trees and shrubs on the slopes of the embankment and continued wave erosion of the upstream slope could ultimately impair the structural stability of the dam.

b. Design and Construction Data. No design or construction data were available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Operating Records. Operation of the drawdown facilities are discussed in Section 4 of this report.

d. Post Construction Changes. Mr. Hayes reported that the original spillway consisted of an excavated channel through the right abutment. The present concrete sill (control structure) across the entrance of the spillway was installed in 1976.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of the magnitude predicted in this area is not expected to cause structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The structural stability of this dam appears to be adequate. Deficiencies in maintenance (uncontrolled tree growth and erosion of upstream face) could ultimately affect the structural integrity of the embankment. Based upon the approximate data available for analyses, the dam will not be overtopped by the one percent probability flood. The flood resulting from the 1/2 PMF will overtop the dam about 1.2 feet for a period of about 5 hours. However, most of the discharge for the 1/2 PMF storm will flow around the ends of the dam rather than over the dam proper. Clearing the downstream channel would improve spillway efficiency.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report are based upon performance history and visual observations. Seepage and stability analyses comparable to the requirements of the guidelines were not available which is considered a deficiency.

c. Urgency. The remedial and maintenance measures recommended in paragraph 7.2 should be pursued on a high priority basis.

d. Necessity for Further Investigations. The additional studies and analyses recommended in paragraph 7.2 should be accomplished by the owner in the near future.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to be hazardous to this dam. It is recommended, however, that the prescribed seismic loading for Seismic Zone 1 be applied in any stability analyses performed for this dam.

7.2 REMEDIAL MEASURES

The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance of a registered professional engineer experienced in the design and construction of earth dams.

a. Alternatives.

(1) The spillway size and/or the height of dam should be increased to pass 50 percent of the Probable Maximum Flood without overtopping the dam.

b. Operation and Maintenance Procedures.

(1) Additional information should be obtained on the topographic characteristics of the reservoir area to determine the overtopping potential of the dam and abutment areas. The present low areas on each end of the dam could be developed as emergency spillways, if required.

(2) Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" should be performed and made a matter of record.

(3) The installation of riprap (concrete rubble or other) on the upstream slope should be completed.

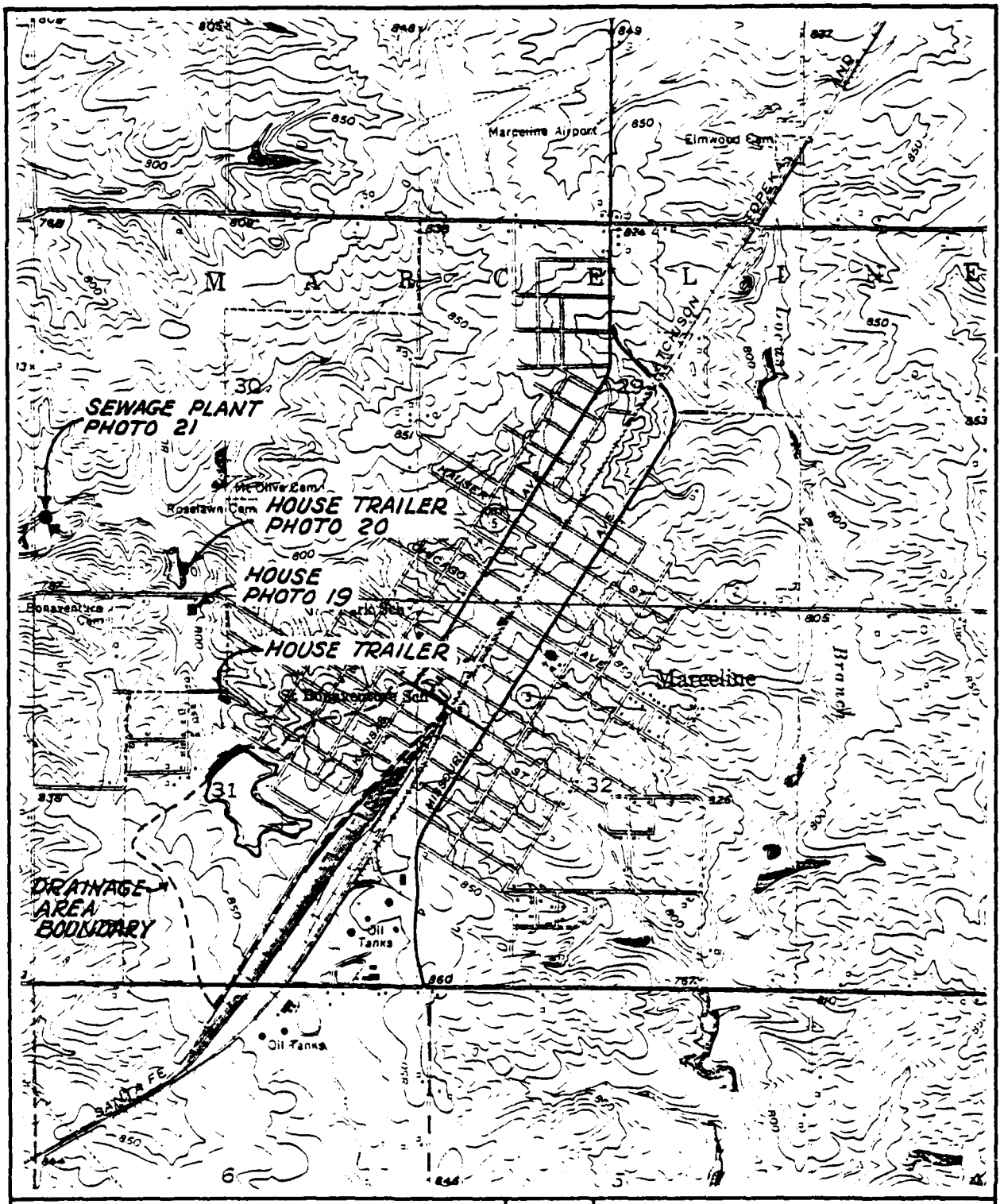
(4) Trees and brush should be removed from the embankment slopes and crest lines and measures taken to prevent their recurrence.

(5) The downstream slope should be seeded with adapted grasses and legumes following clearing of brush and small trees.

(6) The spillway channel should be cleared of brush and trees for at least 200 feet downstream from the crest, and measures taken to prevent their recurrence. The spillway exit channel from the roadway to the channel bottom should be stabilized with large riprap or other material after the channel is cleared.

(7) A program of regular inspection and maintenance should be initiated in order to protect the integrity of the dam.

APPENDIX A
MAPS



Scale in feet

2000 1000 0 2000 4000

Contour Interval – 10′

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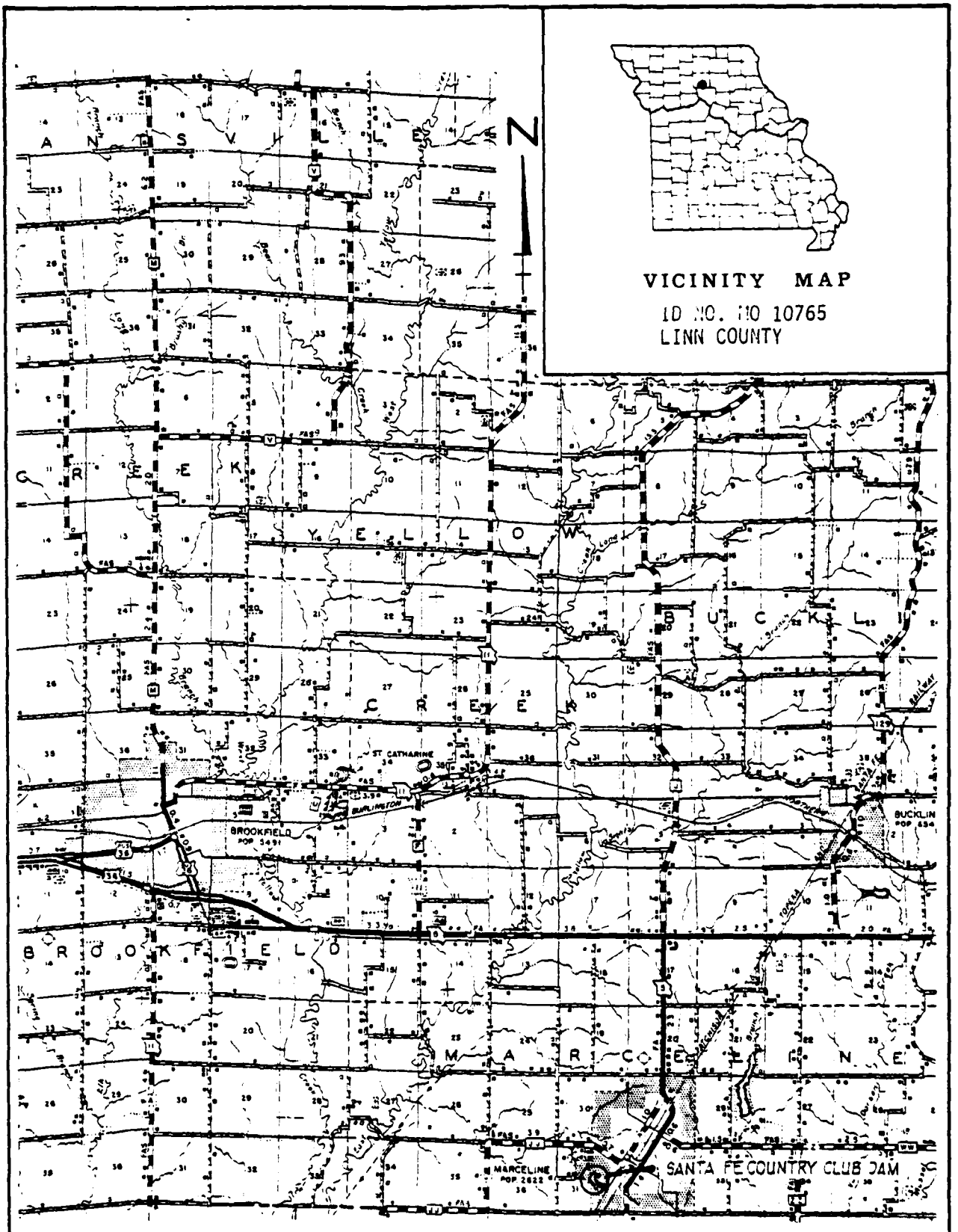
VICINITY TOPOGRAPHY

SANTA FE COUNTRY CLUB DAM
LINN COUNTY, MISSOURI
MO 10765

PLATE A-1



LOCATION MAP

PLATE A-2

APPENDIX B
PHOTOGRAPHS

SANTA FE COUNTRY CLUB DAM
LINN COUNTY, MISSOURI
MO 10765

PHOTO INDEX

PLATE B-1

PHOTO NO. 2 - VIEW OF UPSTREAM SLOPE FROM RIGHT ABUTMENT

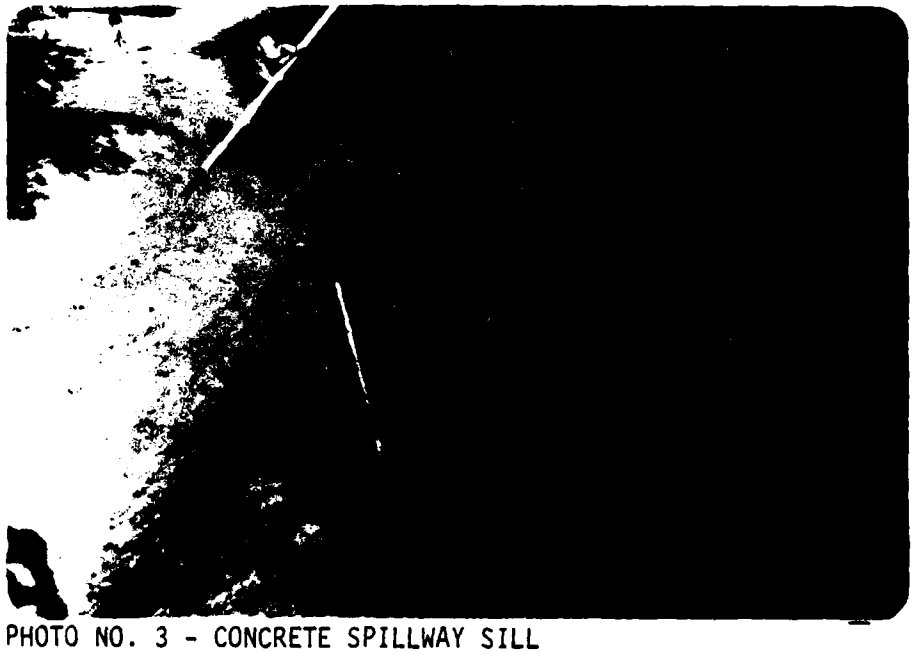


PHOTO NO. 3 - CONCRETE SPILLWAY SILL

PHOTO NO. 4 - VIEW DOWNSTREAM IN SPILLWAY

PHOTO NO. 5 - OUTLET END OF DRAWDOWN SYSTEM

PHOTO NO. 6 - ENTRANCE TO SPILLWAY. ROD SET ON TOP OF CONCRETE SILL

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PHOTO NO. 11 - VIEW OF UPSTREAM SLOPE FROM LEFT END.

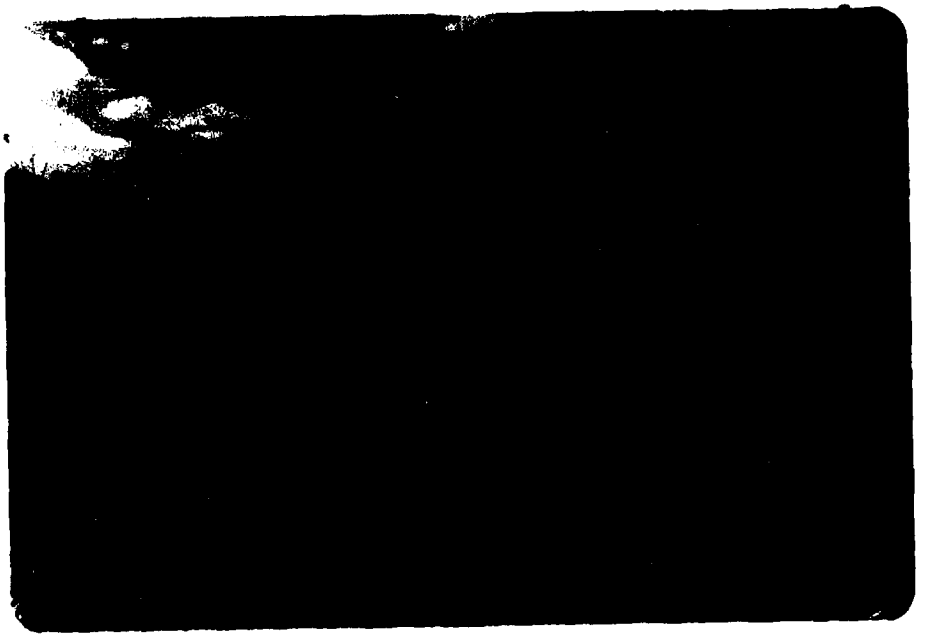


PHOTO NO. 12 - DOWNSTREAM SLOPE FROM LEFT END.
NOTE BRUSH AND TREE REMOVAL.

PHOTO NO. 13 -
MUD DAUBS FROM CRAYFISH
HOLES DOWNSTREAM FROM
STA. 3+20

PHOTO NO. 14 - VIEW ALONG TOE AT MAXIMUM SECTION.
WHITE COVER ON GROUND IS DRIED MOSS.

PHOTO NO. 15 -
SEEPAGE IN OUTLET
CHANNEL OF SPILLWAY

PHOTO NO. 16 - SEVERE EROSION IN LEFT BANK OF SPILLWAY EXIT CHANNEL.

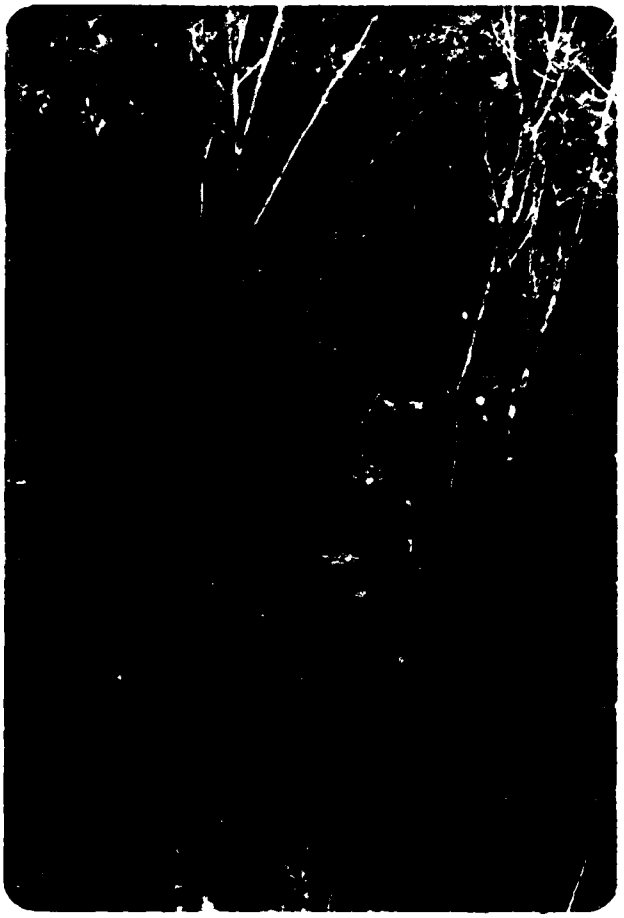


PHOTO NO. 17 - EROSION IN SPILLWAY EXIT CHANNEL.

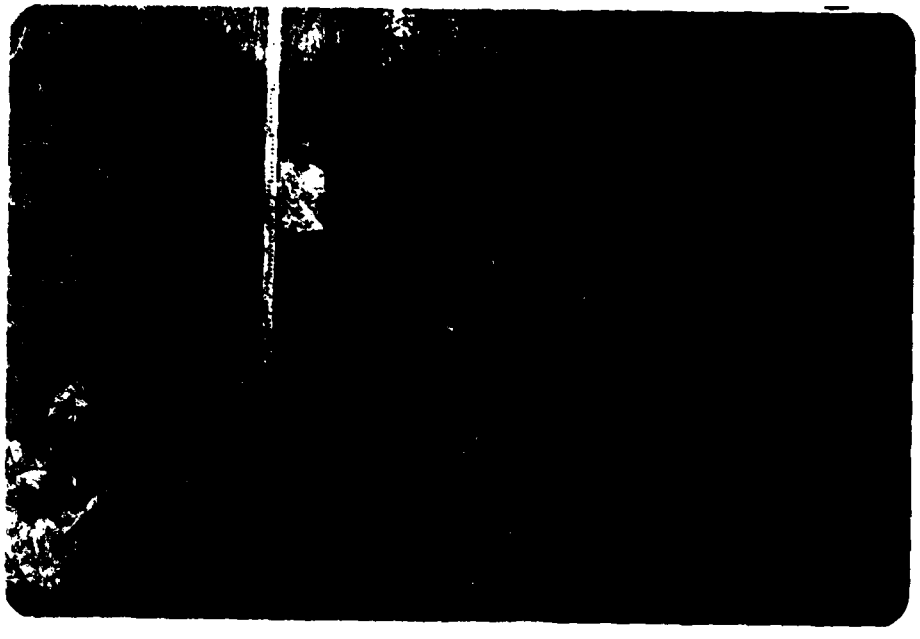


PHOTO NO. 18 - WASHOUT IN SPILLWAY EXIT CHANNEL.
VIEW LOOKING UPSTREAM.

PHOTO NO. 19 - HOUSE IN FLOODPLAIN APPROXIMATELY
2100 FEET DOWNSTREAM FROM DAM.

PHOTO NO. 20 - HOUSE TRAILER IN FLOODPLAIN APPROXIMATELY 2500 FEET DOWNSTREAM OF DAM.

PHOTO NO. 21 - SEWAGE DISPOSAL PLANT APPROXIMATELY 4000 FEET DOWNSTREAM OF DAM.

APPENDIX C
PROJECT PLATES

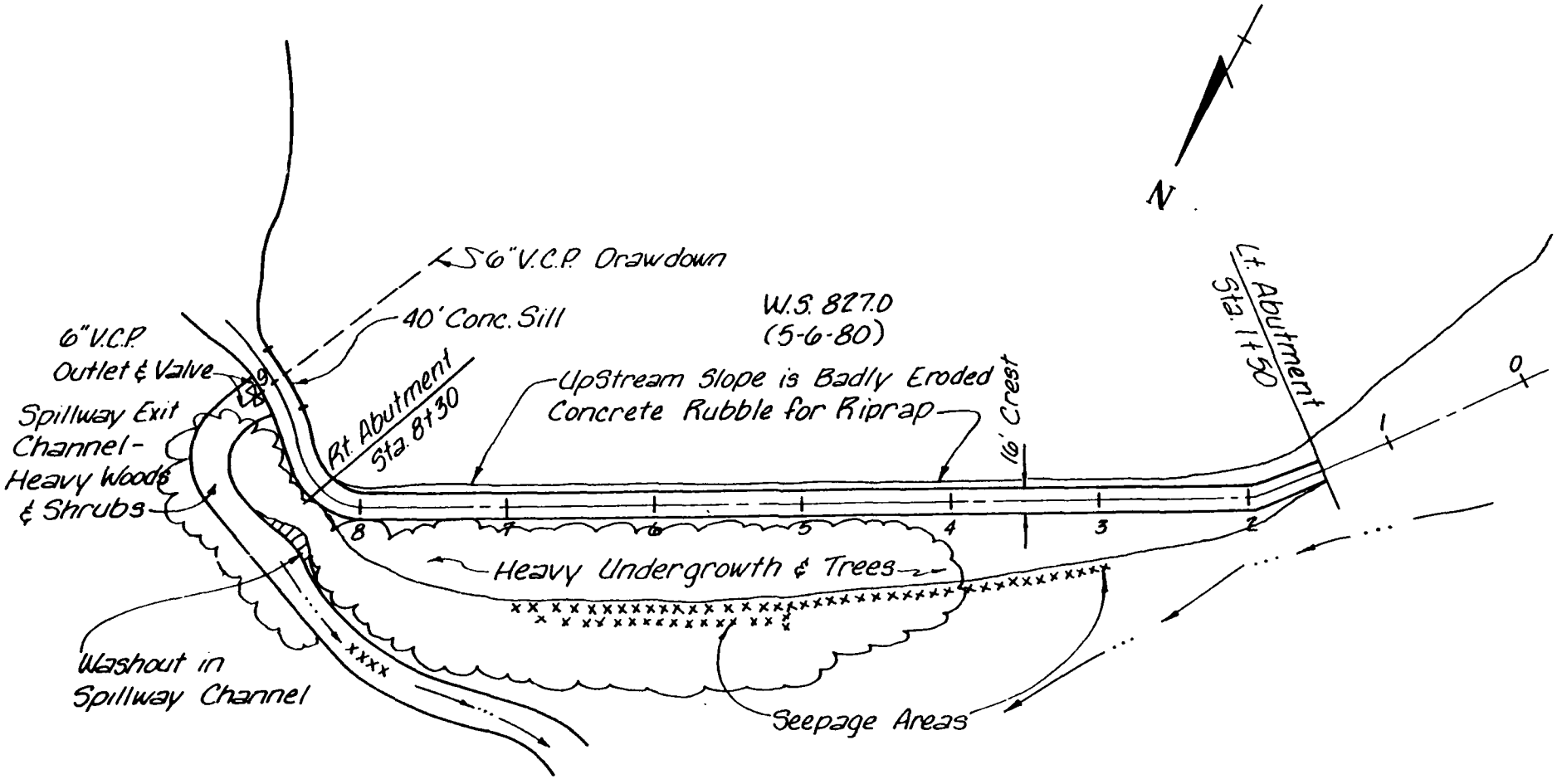
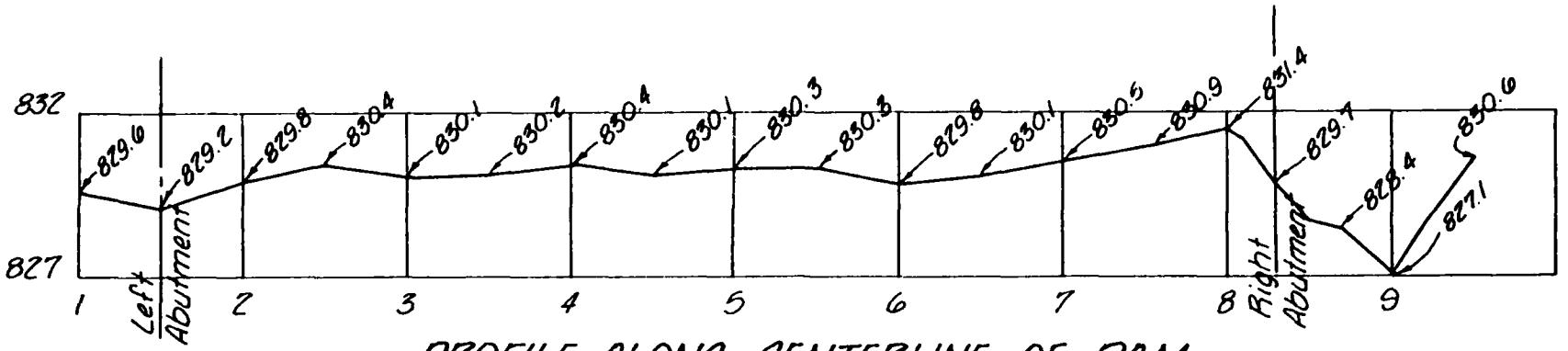


PLATE C-1

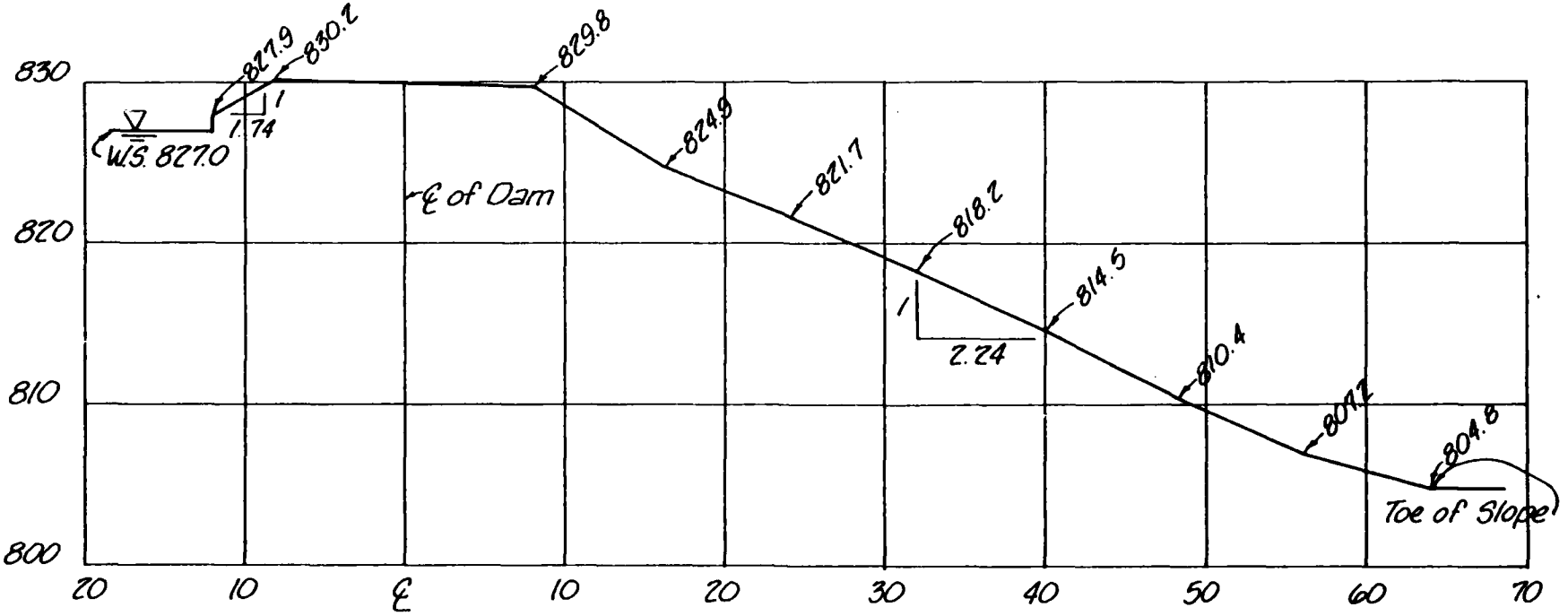
PLAN

Scale: 1" = 100'



PROFILE ALONG CENTERLINE OF DAM

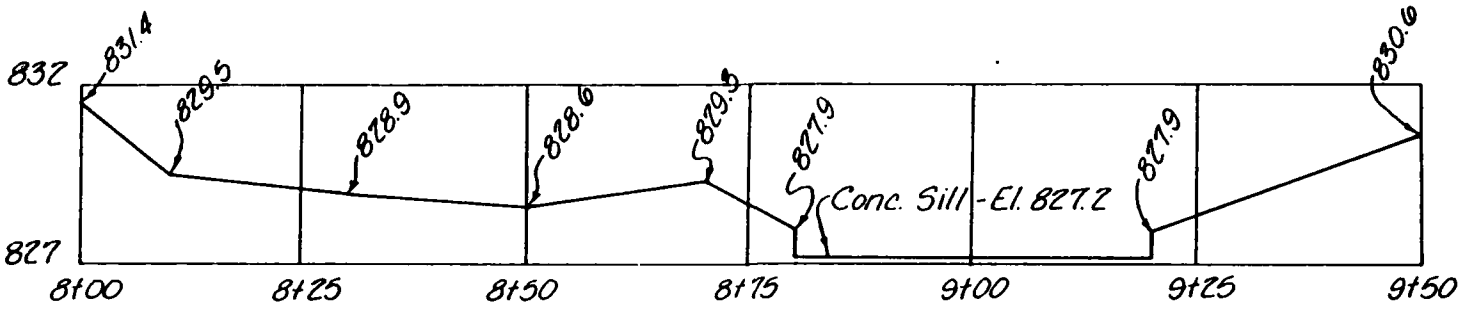
Scale: 1" = 100' H.
1" = 5' V.



MAXIMUM CROSS-SECTION OF DAM AT STA. 5+75

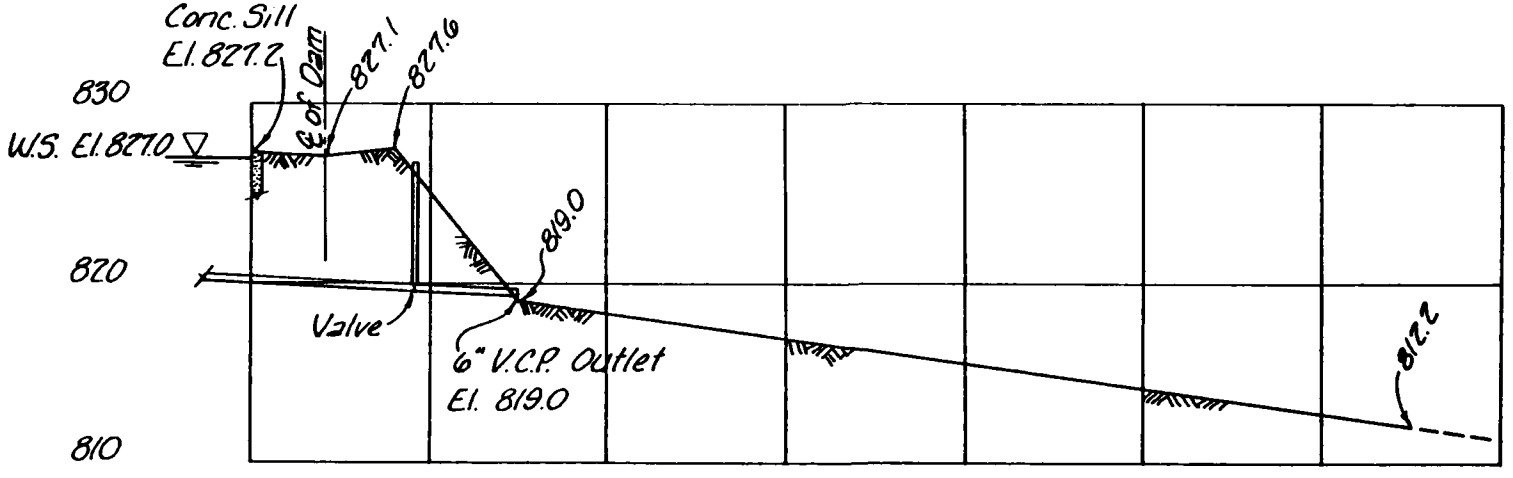
Scale: 1" = 10' H, 1" = 10' V.

PLATE C-2



SPILLWAY SECTION - 8' UPSTREAM OF CENTERLINE

Scale : 1" = 20' H.
1" = 5' V.



CENTERLINE PROFILE OF SPILLWAY

Scale : 1" = 20' H.
1" = 10' V.

PLATE C-3

APPENDIX D
HYDRAULIC AND HYDROLOGIC DATA

HYDROLOGIC COMPUTATIONS

1. The SCS dimensionless unit hydrograph and the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Corps of Engineers, Davis, California, were used to develop the inflow hydrographs (See this Section).

   a. Twenty-four hour, one percent probability rainfall for the dam location was taken from the data for the rainfall station at Moberly, MO. as supplied by the St. Louis District, Corps of Engineers per their letter dated 4 March 1980. The twenty-four probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis policy and guidance for hydraulics and hydrology.

   b. Drainage area = 0.266 square miles (170 acres).

   c. Time of concentration of runoff = 20 minutes (computed by the SCS "Upland" method).

   d. The antecedent storm conditions for the probable maximum precipitation were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMC III). The antecedent storm conditions for the one percent probability precipitation were an average of the conditions which have preceded the occurrence of the maximum annual flood on numerous watersheds (SCS AMC II). The initial pool elevation was assumed at the crest of the spillway.

   e. The total twenty-four hour storm duration losses for the one percent probability storm were 2.10 inches. The total losses for the PMF storm were 1.02 inches. These data are based on SCS runoff curve No. 92 and No. 82 for antecedent moisture conditions SCS AMC III and AMC II respectively. The watershed is composed of SCS soil groups C and D (Kilwinning silt loam and Armstrong loam respectively) with land usage primarily urban (residential) and grassed park areas.

   f. Average soil loss rates = 0.05 inch per hour approximately.

2. The spillway discharge rating was developed using the Corps of Engineers Water Surface Profile HEC-2 computer program assuming critical depth downstream of the control section.

   The flows over the dam crest were developed using the HEC-1 (Dam Safety Version) program with the irregular top of dam option and with field measurements.

3. Floods were routed through the reservoir using the HEC-1 (Dam Safety Version) program to determine the capabilities of the spillway and dam embankment crest. The input, output, and plotted hydrographs are attached in this Appendix.

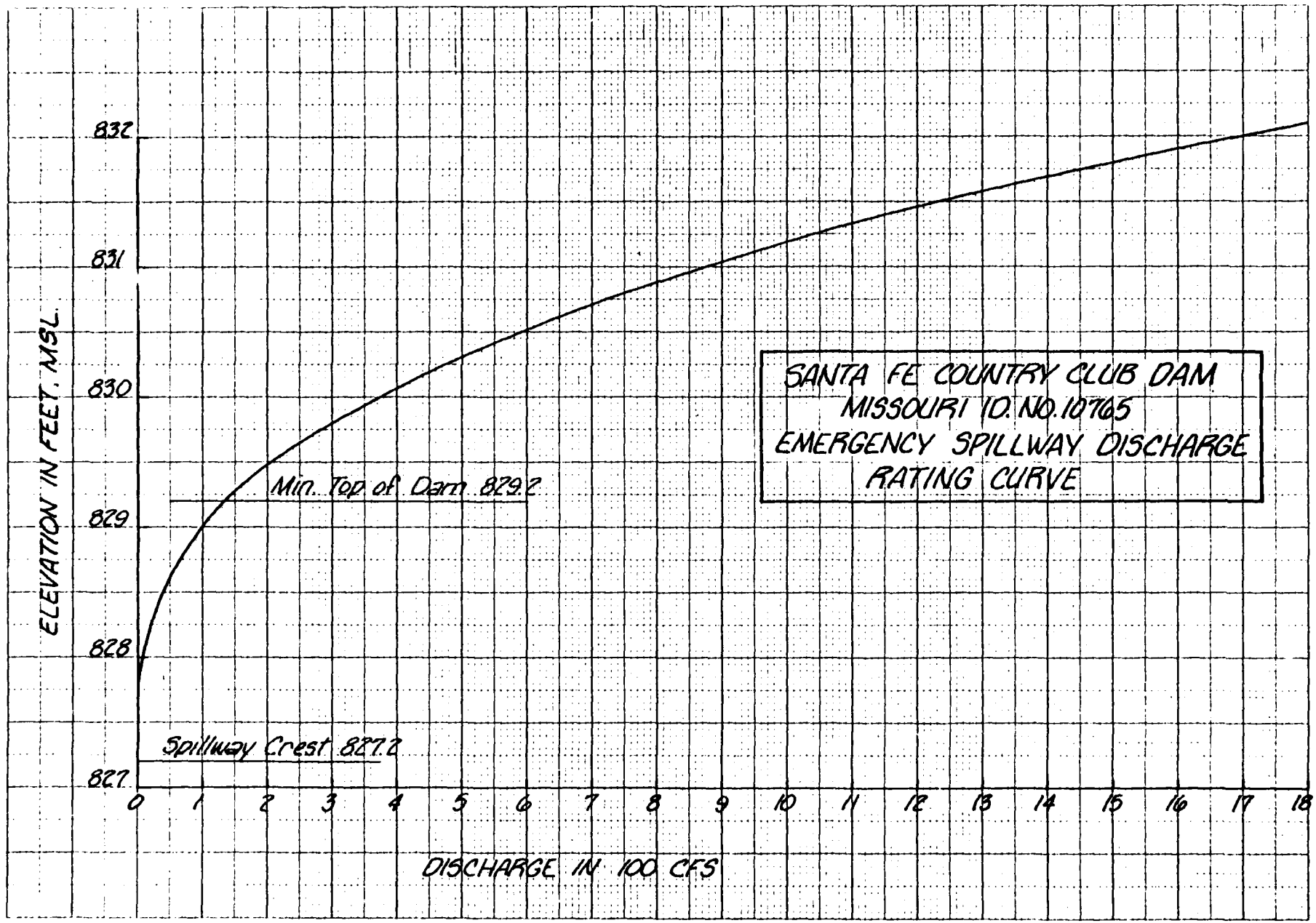

832
831
830
829
828
827
ELEVATION IN FEET, MSL.
Min. Top of Dam 829.2
Spillway Crest 827.2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
DISCHARGE IN 100 CFS
SANTA FE COUNTRY CLUB DAM
MISSOURI I.D. NO. 10765
EMERGENCY SPILLWAY DISCHARGE
RATING CURVE

PLATE D-2

```
A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
A2       H&H ANALYSIS OF SAFETY OF SANTA FE COUNTRY CLUB-MO ID 10765
A3       RATIOS OF PMF ROUTED THRU RESERVOIR
E 0002880000000000000005                              00000000000000000000003
B1000005
J 0000010000000900000001
J1000.0500000.1000000.1500000.2000000.2500000.3000000.3500000.50000001.0
K 00000000000001                      00000000000000000000001
K1       CALCULATION OF INFLOW HYDROGRAPH TO RESERVOIR 10765
M 0000010000000020000.266             0000.266000001.0                    00000001
P 000000000024.200000102000001210000013O
I                                                          -1.0     -92.
W2       00000.20
X 000000     -.0100000001
K 00000100000002                      00000002000000000000001
K1       ROUTED FLOWS THRU RESERVOIR 10765
Y                           00000001000000001
Y1000001                                                  -827.2       -1
Y+0827.2000829.0000829.5000829.8000830.1000830.3000830.5000830.7000830.9000831.0
Y40831.2000831.3000831.4000831.8000832.3000833.0
Y5000000000001000000020000000300000004000000050000000600000007000000080000000900
Y5001000000011000000120000001500000020000000300O
$A000000000016.2000019.4000023.2000033.5
$E000805000008270008285000008300000835
$$0827.2
$D0829.2000002.3000001.500000800
$L00000000000060000001100000022800000542000006250000070600000774000008000000800
$V0829.2000829.5000829.8000830.1000830.3000830.4000830.9000831.4000832.2000833.0
K 000099
A
A
A
A
A
```

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

RUN  DATE= 80/05/22.
     TIME= 17.54.28.
```

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HGH ANALYSIS OF SAFETY OF SANTA FE COUNTRY CLUB-MO ID 10765
RATIOS OF PMF ROUTED THRU RESERVOIR

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	5	0	0	0	0	0	3	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS= .05 .10 .15 .20 .25 .30 .35 .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH TO RESERVOIR 10765

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000001	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.27	0.00	.27	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.20	102.00	121.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-92.00	0.00	0.00

CURVE NO = -92.00 WETNESS = -1.00 EFFECT CN = 92.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .20

RECESSION DATA
STRTQ= 0.00 QRCSN= -.01 RTIOR= 1.00

UNIT HYDROGRAPH 14 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .20 VOL= 1.00

130.	427.	530.	424.	236.	136.	77.	44.	25.	14.
9.	5.	3.	1.					

0 END-OF-PERIOD FLOW

PLATE D-4

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.05	145	.21	.20	.00	147.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.10	146	.21	.20	.00	186.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.15	147	.21	.20	.00	280.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.20	148	.21	.20	.00	339.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.25	149	.21	.20	.00	373.
1.01	.30	6	.01	0.00	.01	0.	1.01	12.30	150	.21	.20	.00	392.
1.01	.35	7	.01	0.00	.01	0.	1.01	12.35	151	.21	.20	.00	403.
1.01	.40	8	.01	0.00	.01	0.	1.01	12.40	152	.21	.20	.00	409.
1.01	.45	9	.01	0.00	.01	0.	1.01	12.45	153	.21	.20	.00	413.
1.01	.50	10	.01	0.00	.01	0.	1.01	12.50	154	.21	.20	.00	416.
1.01	.55	11	.01	0.00	.01	0.	1.01	12.55	155	.21	.20	.00	417.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.00	156	.21	.20	.00	418.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.05	157	.25	.24	.00	424.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.10	158	.25	.24	.00	442.
1.01	1.15	15	.01	.00	.01	0.	1.01	13.15	159	.25	.24	.00	463.
1.01	1.20	16	.01	.00	.01	0.	1.01	13.20	160	.25	.24	.00	481.
1.01	1.25	17	.01	.00	.01	0.	1.01	13.25	161	.25	.24	.00	491.
1.01	1.30	18	.01	.00	.01	1.	1.01	13.30	162	.25	.24	.00	497.
1.01	1.35	19	.01	.00	.01	1.	1.01	13.35	163	.25	.25	.00	500.
1.01	1.40	20	.01	.00	.01	2.	1.01	13.40	164	.25	.25	.00	502.
1.01	1.45	21	.01	.00	.01	2.	1.01	13.45	165	.25	.25	.00	503.
1.01	1.50	22	.01	.00	.01	3.	1.01	13.50	166	.25	.25	.00	504.
1.01	1.55	23	.01	.00	.01	3.	1.01	13.55	167	.25	.25	.00	504.
1.01	2.00	24	.01	.00	.01	4.	1.01	14.00	168	.25	.25	.00	505.
1.01	2.05	25	.01	.00	.01	4.	1.01	14.05	169	.31	.31	.00	513.
1.01	2.10	26	.01	.00	.01	5.	1.01	14.10	170	.31	.31	.00	539.
1.01	2.15	27	.01	.00	.01	5.	1.01	14.15	171	.31	.31	.00	572.
1.01	2.20	28	.01	.00	.01	6.	1.01	14.20	172	.31	.31	.00	598.
1.01	2.25	29	.01	.00	.01	6.	1.01	14.25	173	.31	.31	.00	613.
1.01	2.30	30	.01	.00	.01	7.	1.01	14.30	174	.31	.31	.00	621.
1.01	2.35	31	.01	.00	.01	7.	1.01	14.35	175	.31	.31	.00	626.
1.01	2.40	32	.01	.00	.01	8.	1.01	14.40	176	.31	.31	.00	629.
1.01	2.45	33	.01	.00	.01	8.	1.01	14.45	177	.31	.31	.00	631.
1.01	2.50	34	.01	.00	.01	8.	1.01	14.50	178	.31	.31	.00	632.
1.01	2.55	35	.01	.00	.01	9.	1.01	14.55	179	.31	.31	.00	632.
1.01	3.00	36	.01	.00	.01	9.	1.01	15.00	180	.31	.31	.00	631.
1.01	3.05	37	.01	.01	.01	9.	1.01	15.05	181	.19	.19	.00	617.
1.01	3.10	38	.01	.01	.01	10.	1.01	15.10	182	.38	.37	.00	590.
1.01	3.15	39	.01	.01	.01	10.	1.01	15.15	183	.38	.37	.00	606.
1.01	3.20	40	.01	.01	.01	10.	1.01	15.20	184	.56	.56	.00	679.
1.01	3.25	41	.01	.01	.01	11.	1.01	15.25	185	.66	.65	.00	822.
1.01	3.30	42	.01	.01	.01	11.	1.01	15.30	186	1.59	1.59	.00	1110.
1.01	3.35	43	.01	.01	.01	11.	1.01	15.35	187	2.63	2.62	.00	1789.
1.01	3.40	44	.01	.01	.01	12.	1.01	15.40	188	1.03	1.03	.00	2611.
1.01	3.45	45	.01	.01	.01	12.	1.01	15.45	189	.66	.66	.00	2878.
1.01	3.50	46	.01	.01	.01	12.	1.01	15.50	190	.56	.56	.00	2550.
1.01	3.55	47	.01	.01	.01	12.	1.01	15.55	191	.38	.37	.00	2000.
1.01	4.00	48	.01	.01	.01	13.	1.01	16.00	192	.38	.37	.00	1556.
1.01	4.05	49	.01	.01	.01	13.	1.01	16.05	193	.29	.29	.00	1230.
1.01	4.10	50	.01	.01	.01	13.	1.01	16.10	194	.29	.29	.00	991.
1.01	4.15	51	.01	.01	.01	13.	1.01	16.15	195	.29	.29	.00	830.
1.01	4.20	52	.01	.01	.01	14.	1.01	16.20	196	.29	.29	.00	727.
1.01	4.25	53	.01	.01	.01	14.	1.01	16.25	197	.29	.29	.00	669.
1.01	4.30	54	.01	.01	.01	14.	1.01	16.30	198	.29	.29	.00	636.
1.01	4.35	55	.01	.01	.00	14.	1.01	16.35	199	.29	.29	.00	617.
1.01	4.40	56	.01	.01	.00	14.	1.01	16.40	200	.29	.29	.00	604.
1.01	4.45	57	.01	.01	.00	15.	1.01	16.45	201	.29	.29	.00	597.
1.01	4.50	58	.01	.01	.00	15.	1.01	16.50	202	.29	.29	.00	595.
1.01	4.55	59	.01	.01	.00	15.	1.01	16.55	203	.29	.29	.00	593.
1.01	5.00	60	.01	.01	.00	15.	1.01	17.00	204	.29	.29	.00	591.

PLATE D-5

1.01	5.05	61	.01	.01	.00	15.	1.01	17.05	205	.23	.23	.00	564.
1.01	5.10	62	.01	.01	.00	15.	1.01	17.10	206	.23	.23	.00	550.
1.01	5.15	63	.01	.01	.00	16.	1.01	17.15	207	.23	.23	.00	529.
1.01	5.20	64	.01	.01	.00	16.	1.01	17.20	208	.23	.23	.00	499.
1.01	5.25	65	.01	.01	.00	16.	1.01	17.25	209	.23	.23	.00	485.
1.01	5.30	66	.01	.01	.00	16.	1.01	17.30	210	.23	.23	.00	476.
1.01	5.35	67	.01	.01	.00	16.	1.01	17.35	211	.23	.23	.00	472.
1.01	5.40	68	.01	.01	.00	16.	1.01	17.40	212	.23	.23	.00	469.
1.01	5.45	69	.01	.01	.00	16.	1.01	17.45	213	.23	.23	.00	467.
1.01	5.50	70	.01	.01	.00	17.	1.01	17.50	214	.23	.23	.00	466.
1.01	5.55	71	.01	.01	.00	17.	1.01	17.55	215	.23	.23	.00	466.
1.01	6.00	72	.01	.01	.00	17.	1.01	18.00	216	.23	.23	.00	466.
1.01	6.05	73	.06	.04	.02	22.	1.01	18.05	217	.02	.02	.00	437.
1.01	6.10	74	.06	.05	.02	38.	1.01	18.10	218	.02	.02	.00	350.
1.01	6.15	75	.06	.05	.02	58.	1.01	18.15	219	.02	.02	.00	239.
1.01	6.20	76	.06	.05	.02	75.	1.01	18.20	220	.02	.02	.00	151.
1.01	6.25	77	.06	.05	.01	85.	1.01	18.25	221	.02	.02	.00	102.
1.01	6.30	78	.06	.05	.01	92.	1.01	18.30	222	.02	.02	.00	74.
1.01	6.35	79	.06	.05	.01	97.	1.01	18.35	223	.02	.02	.00	58.
1.01	6.40	80	.06	.05	.01	101.	1.01	18.40	224	.02	.02	.00	49.
1.01	6.45	81	.06	.05	.01	103.	1.01	18.45	225	.02	.02	.00	44.
1.01	6.50	82	.06	.05	.01	106.	1.01	18.50	226	.02	.02	.00	41.
1.01	6.55	83	.06	.05	.01	108.	1.01	18.55	227	.02	.02	.00	39.
1.01	7.00	84	.06	.05	.01	109.	1.01	19.00	228	.02	.02	.00	38.
1.01	7.05	85	.06	.06	.01	110.	1.01	19.05	229	.02	.02	.00	38.
1.01	7.10	86	.06	.06	.01	112.	1.01	19.10	230	.02	.02	.00	37.
1.01	7.15	87	.06	.06	.01	113.	1.01	19.15	231	.02	.02	.00	37.
1.01	7.20	88	.06	.06	.01	114.	1.01	19.20	232	.02	.02	.00	37.
1.01	7.25	89	.06	.06	.01	115.	1.01	19.25	233	.02	.02	.00	37.
1.01	7.30	90	.06	.06	.01	116.	1.01	19.30	234	.02	.02	.00	37.
1.01	7.35	91	.06	.06	.01	116.	1.01	19.35	235	.02	.02	.00	37.
1.01	7.40	92	.06	.06	.01	117.	1.01	19.40	236	.02	.02	.00	37.
1.01	7.45	93	.06	.06	.01	118.	1.01	19.45	237	.02	.02	.00	37.
1.01	7.50	94	.06	.06	.01	118.	1.01	19.50	238	.02	.02	.00	37.
1.01	7.55	95	.06	.06	.01	119.	1.01	19.55	239	.02	.02	.00	37.
1.01	8.00	96	.06	.06	.01	120.	1.01	20.00	240	.02	.02	.00	37.
1.01	8.05	97	.06	.06	.00	120.	1.01	20.05	241	.02	.02	.00	37.
1.01	8.10	98	.06	.06	.00	121.	1.01	20.10	242	.02	.02	.00	37.
1.01	8.15	99	.06	.06	.00	121.	1.01	20.15	243	.02	.02	.00	37.
1.01	8.20	100	.06	.06	.00	121.	1.01	20.20	244	.02	.02	.00	37.
1.01	8.25	101	.06	.06	.00	122.	1.01	20.25	245	.02	.02	.00	37.
1.01	8.30	102	.06	.06	.00	122.	1.01	20.30	246	.02	.02	.00	37.
1.01	8.35	103	.06	.06	.00	123.	1.01	20.35	247	.02	.02	.00	37.
1.01	8.40	104	.06	.06	.00	123.	1.01	20.40	248	.02	.02	.00	37.
1.01	8.45	105	.06	.06	.00	123.	1.01	20.45	249	.02	.02	.00	37.
1.01	8.50	106	.06	.06	.00	123.	1.01	20.50	250	.02	.02	.00	37.
1.01	8.55	107	.06	.06	.00	124.	1.01	20.55	251	.02	.02	.00	37.
1.01	9.00	108	.06	.06	.00	124.	1.01	21.00	252	.02	.02	.00	37.
1.01	9.05	109	.06	.06	.00	124.	1.01	21.05	253	.02	.02	.00	37.
1.01	9.10	110	.06	.06	.00	125.	1.01	21.10	254	.02	.02	.00	37.
1.01	9.15	111	.06	.06	.00	125.	1.01	21.15	255	.02	.02	.00	37.
1.01	9.20	112	.06	.06	.00	125.	1.01	21.20	256	.02	.02	.00	37.
1.01	9.25	113	.06	.06	.00	125.	1.01	21.25	257	.02	.02	.00	37.
1.01	9.30	114	.06	.06	.00	125.	1.01	21.30	258	.02	.02	.00	37.
1.01	9.35	115	.06	.06	.00	126.	1.01	21.35	259	.02	.02	.00	37.
1.01	9.40	116	.06	.06	.00	126.	1.01	21.40	260	.02	.02	.00	37.
1.01	9.45	117	.06	.06	.00	126.	1.01	21.45	261	.02	.02	.00	37.
1.01	9.50	118	.06	.06	.00	126.	1.01	21.50	262	.02	.02	.00	37.
1.01	9.55	119	.06	.06	.00	126.	1.01	21.55	263	.02	.02	.00	37.
1.01	10.00	120	.06	.06	.00	126.	1.01	22.00	264	.02	.02	.00	37.
1.01	10.05	121	.06	.06	.00	127.	1.01	22.05	265	.02	.02	.00	37.
1.01	10.10	122	.06	.06	.00	127.	1.01	22.10	266	.02	.02	.00	37.

PLATE D-6

1.01	10.15	123	.06	.06	.00	127.	1.01	22.15	267	.02	.02	.00	37.
1.01	10.20	124	.06	.06	.00	127.	1.01	22.20	268	.02	.02	.00	37.
1.01	10.25	125	.06	.06	.00	127.	1.01	22.25	269	.02	.02	.00	37.
1.01	10.30	126	.06	.06	.00	127.	1.01	22.30	270	.02	.02	.00	37.
1.01	10.35	127	.06	.06	.00	127.	1.01	22.35	271	.02	.02	.00	37.
1.01	10.40	128	.06	.06	.00	127.	1.01	22.40	272	.02	.02	.00	37.
1.01	10.45	129	.06	.06	.00	127.	1.01	22.45	273	.02	.02	.00	37.
1.01	10.50	130	.06	.06	.00	128.	1.01	22.50	274	.02	.02	.00	37.
1.01	10.55	131	.06	.06	.00	128.	1.01	22.55	275	.02	.02	.00	37.
1.01	11.00	132	.06	.06	.00	128.	1.01	23.00	276	.02	.02	.00	37.
1.01	11.05	133	.06	.06	.00	128.	1.01	23.05	277	.02	.02	.00	37.
1.01	11.10	134	.06	.06	.00	128.	1.01	23.10	278	.02	.02	.00	37.
1.01	11.15	135	.06	.06	.00	128.	1.01	23.15	279	.02	.02	.00	37.
1.01	11.20	136	.06	.06	.00	128.	1.01	23.20	280	.02	.02	.00	37.
1.01	11.25	137	.06	.06	.00	128.	1.01	23.25	281	.02	.02	.00	37.
1.01	11.30	138	.06	.06	.00	128.	1.01	23.30	282	.02	.02	.00	37.
1.01	11.35	139	.06	.06	.00	128.	1.01	23.35	283	.02	.02	.00	37.
1.01	11.40	140	.06	.06	.00	128.	1.01	23.40	284	.02	.02	.00	37.
1.01	11.45	141	.06	.06	.00	128.	1.01	23.45	285	.02	.02	.00	37.
1.01	11.50	142	.06	.06	.00	129.	1.01	23.50	286	.02	.02	.00	37.
1.01	11.55	143	.06	.06	.00	129.	1.01	23.55	287	.02	.02	.00	37.
1.01	12.00	144	.06	.06	.00	129.	1.02	0.00	288	.02	.02	.00	37.

SUM	31.46	30.44	1.02	62551.
	(799.1(	773.1(	26.1(	1771.25)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2878.	696.	217.	217.	62550.
CMS	82.	20.	6.	6.	1771.
INCHES		24.34	30.38	30.38	30.38
MM		618.18	771.68	771.68	771.68
AC-FT		345.	431.	431.	431.
THOUS CU M		426.	531.	531.	531.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	144.	35.	11.	11.	3127.
CMS	4.	1.	0.	0.	89.
INCHES		1.22	1.52	1.52	1.52
MM		30.91	38.58	38.58	38.58
AC-FT		17.	22.	22.	22.
THOUS CU M		21.	27.	27.	27.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	288.	70.	22.	22.	6255.
CMS	8.	2.	1.	1.	177.
INCHES		2.43	3.04	3.04	3.04
MM		61.82	77.17	77.17	77.17
AC-FT		35.	43.	43.	43.
THOUS CU M		43.	53.	53.	53.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 3

PLATE D-7

CMS	41.	10.	3.	3.	886.
INCHES		12.17	15.19	15.19	15.19
MM		309.09	385.84	385.84	385.84
AC-FT		173.	215.	215.	215.
THOUS CU M		213.	266.	266.	266.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2878.	696.	217.	217.	62550.
CMS	82.	20.	6.	6.	1771.
INCHES		24.34	30.38	30.38	30.38
MM		618.18	771.68	771.68	771.68
AC-FT		345.	431.	431.	431.
THOUS CU M		426.	531.	531.	531.

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HYDROGRAPH ROUTING

ROUTED FLOWS THRU RESERVOIR 10765

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000002	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-827.	-1

STAGE	827.20	829.00	829.50	829.80	830.10	830.30	830.50	830.70	830.90	831.00
	831.20	831.30	831.40	831.80	832.30	833.00				
FLOW	0.00	100.00	200.00	300.00	400.00	500.00	600.00	700.00	800.00	900.00
	1000.00	1100.00	1200.00	1500.00	2000.00	3000.00				
SURFACE AREA=	0.	16.	19.	23.	34.					
CAPACITY=	0.	119.	145.	177.	318.					
ELEVATION=	805.	827.	829.	830.	835.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
827.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
829.2	2.3	1.5	800.

CREST LENGTH	0.	60.	110.	228.	542.	625.	706.	774.	800.	800.
AT OR BELOW ELEVATION	829.2	829.5	829.8	830.1	830.3	830.4	830.9	831.4	832.2	833.0

STATION 000002, PLAN 1, RATIO 1

PLATE D-8

IVM

STATION 000002, PLAN 1, RATIO 4 **0.2 PMF**

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	3.	3.	3.	4.
4.	4.	5.	5.	6.	6.	6.	7.	7.	7.
8.	8.	8.	9.	9.	9.	10.	10.	10.	11.
11.	11.	12.	12.	12.	12.	13.	13.	13.	13.
14.	14.	14.	14.	15.	15.	15.	15.	16.	16.
16.	16.	16.	17.	17.	17.	17.	17.	18.	18.
18.	18.	18.	18.	19.	19.	19.	19.	19.	19.
19.	20.	20.	20.	20.	20.	21.	22.	23.	24.
25.	26.	28.	29.	30.	31.	32.	33.	35.	36.
37.	38.	40.	41.	42.	43.	45.	46.	47.	48.
49.	51.	52.	54.	55.	56.	58.	59.	61.	62.
64.	64.	65.	67.	68.	71.	75.	82.	91.	99.
120.	135.	144.	149.	151.	151.	151.	149.	148.	146.
145.	143.	141.	140.	139.	137.	135.	133.	131.	129.
127.	125.	123.	121.	119.	117.	116.	113.	110.	105.
100.	99.	97.	95.	94.	92.	91.	89.	88.	86.
85.	83.	82.	80.	79.	78.	76.	75.	74.	72.
71.	70.	69.	67.	66.	65.	64.	63.	62.	61.
60.	59.	58.	57.	56.	55.	54.	53.	52.	51.
50.	49.	48.	47.	47.	46.	45.	44.	43.	43.
42.	41.	41.	40.	39.	39.	38.	37.	37.	36.
35.	35.	34.	34.	33.	33.	32.	32.		

STORAGE

122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	123.	123.	123.	123.	123.	123.	123.	123.
123.	123.	123.	123.	123.	123.	123.	123.	123.	123.
123.	123.	124.	124.	124.	124.	124.	124.	124.	124.
124.	125.	125.	125.	125.	125.	125.	125.	125.	125.
125.	126.	126.	126.	126.	126.	126.	126.	126.	126.
126.	126.	126.	126.	127.	127.	127.	127.	127.	127.
127.	127.	127.	127.	127.	127.	127.	127.	127.	127.
128.	128.	128.	128.	128.	128.	128.	128.	128.	128.
128.	128.	128.	128.	128.	128.	128.	129.	129.	129.
130.	130.	131.	131.	131.	132.	132.	132.	133.	133.
134.	134.	134.	135.	135.	136.	136.	136.	137.	137.
138.	138.	139.	139.	140.	140.	141.	141.	141.	142.
142.	143.	143.	144.	144.	145.	146.	149.	152.	155.
158.	159.	160.	161.	161.	161.	161.	161.	160.	160.
160.	160.	160.	160.	160.	159.	159.	159.	159.	158.
158.	158.	158.	158.	157.	157.	157.	157.	156.	156.
155.	155.	154.	154.	153.	153.	152.	151.	151.	150.
150.	149.	149.	148.	148.	147.	147.	146.	146.	146.

PLATE D-9

145.	145.	144.	144.	143.	143.	143.	142.	142.	141.
141.	141.	140.	140.	140.	139.	139.	139.	138.	138.
138.	138.	137.	137.	137.	136.	136.	136.	136.	135.
135.	135.	135.	135.	134.	134.	134.	134.	133.	133.
133.	133.	133.	133.	132.	132.	132.	132.		

STAGE

827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.3	827.3	827.3
827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3
827.3	827.3	827.4	827.4	827.4	827.4	827.4	827.4	827.4	827.4
827.4	827.4	827.4	827.4	827.4	827.4	827.4	827.4	827.4	827.4
827.4	827.5	827.5	827.5	827.5	827.5	827.5	827.5	827.5	827.5
827.5	827.5	827.5	827.5	827.5	827.5	827.5	827.5	827.5	827.5
827.5	827.5	827.5	827.5	827.5	827.5	827.5	827.5	827.5	827.5
827.5	827.6	827.6	827.6	827.6	827.6	827.6	827.6	827.6	827.6
827.7	827.7	827.7	827.7	827.7	827.8	827.8	827.8	827.8	827.8
827.9	827.9	827.9	827.9	828.0	828.0	828.0	828.0	828.0	828.1
828.1	828.1	828.1	828.2	828.2	828.2	828.2	828.3	828.3	828.3
828.3	828.4	828.4	828.4	828.4	828.5	828.5	828.7	828.8	829.0
829.1	829.2	829.2	829.2	829.3	829.3	829.3	829.2	829.2	829.2
829.2	829.2	829.2	829.2	829.2	829.2	829.2	829.2	829.2	829.1
829.1	829.1	829.1	829.1	829.1	829.1	829.1	829.1	829.0	829.0
829.0	829.0	828.9	828.9	828.9	828.9	828.8	828.8	828.9	828.8
828.7	828.7	828.7	828.6	828.6	828.6	828.6	828.5	828.5	828.5
828.5	828.5	828.4	828.4	828.4	828.4	828.4	828.3	828.3	828.3
828.3	828.3	828.2	828.2	828.2	828.2	828.2	828.1	828.1	828.1
828.1	828.1	828.1	828.1	828.0	828.0	828.0	828.0	828.0	828.0
828.0	827.9	827.9	827.9	827.9	827.9	827.9	827.9	827.9	827.8
827.8	827.8	827.8	827.8	827.8	827.8	827.8	827.8		

PEAK OUTFLOW IS 151. AT TIME 16.33 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	151.	100.	39.	39.	11104.
CMS	4.	3.	1.	1.	314.
INCHES		3.51	5.39	5.39	5.39
MM		89.25	136.99	136.99	136.99
AC-FT		50.	76.	76.	76.
THOUS CU M		61.	94.	94.	94.

DVF

STATION000002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	100.	200.	300.	400.	500.	600.	0.	0.	0.	0.	0.	0.
.05	1I	.	.	.	.	.	.	.	.	.	.	.	.
.10	2I	.	.	.	.	.	.	.	.	.	.	.	.
.15	3I	.	.	.	.	.	.	.	.	.	.	.	.
.20	4I	.	.	.	.	.	.	.	.	.	.	.	.
.25	5I	.	.	.	.	.	.	.	.	.	.	.	.
.30	6I	.	.	.	.	.	.	.	.	.	.	.	.
.35	7I	.	.	.	.	.	.	.	.	.	.	.	.
.40	8I	.	.	.	.	.	.	.	.	.	.	.	.
.45	9I	.	.	.	.	.	.	.	.	.	.	.	.
.50	10I	.	.	.	.	.	.	.	.	.	.	.	.
.55	11I	.	.	.	.	.	.	.	.	.	.	.	.
1.00	12I	.	.	.	.	.	.	.	.	.	.	.	.
1.05	13I	.	.	.	.	.	.	.	.	.	.	.	.
1.10	14I	.	.	.	.	.	.	.	.	.	.	.	.
1.15	15I	.	.	.	.	.	.	.	.	.	.	.	.
1.20	16I	.	.	.	.	.	.	.	.	.	.	.	.
1.25	17I	.	.	.	.	.	.	.	.	.	.	.	.
1.30	18I	.	.	.	.	.	.	.	.	.	.	.	.
1.35	19I	.	.	.	.	.	.	.	.	.	.	.	.
1.40	20I	.	.	.	.	.	.	.	.	.	.	.	.
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1.55	23I	.	.	.	.	.	.	.	.	.	.	.	.
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2.05	25I	.	.	.	.	.	.	.	.	.	.	.	.
2.10	26I	.	.	.	.	.	.	.	.	.	.	.	.
2.15	27I	.	.	.	.	.	.	.	.	.	.	.	.
2.20	28I	.	.	.	.	.	.	.	.	.	.	.	.
2.25	29I	.	.	.	.	.	.	.	.	.	.	.	.
2.30	30I	.	.	.	.	.	.	.	.	.	.	.	.
2.35	31I	.	.	.	.	.	.	.	.	.	.	.	.
2.40	32I	.	.	.	.	.	.	.	.	.	.	.	.
2.45	33I	.	.	.	.	.	.	.	.	.	.	.	.
2.50	34I	.	.	.	.	.	.	.	.	.	.	.	.
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3.10	38I	.	.	.	.	.	.	.	.	.	.	.	.
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3.20	40I	.	.	.	.	.	.	.	.	.	.	.	.
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3.30	42I	.	.	.	.	.	.	.	.	.	.	.	.
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4.05	49I	.	.	.	.	.	.	.	.	.	.	.	.
4.10	50I	.	.	.	.	.	.	.	.	.	.	.	.
4.15	51I	.	.	.	.	.	.	.	.	.	.	.	.
4.20	52I	.	.	.	.	.	.	.	.	.	.	.	.
4.25	53I	.	.	.	.	.	.	.	.	.	.	.	.
4.30	54I	.	.	.	.	.	.	.	.	.	.	.	.
4.35	55I	.	.	.	.	.	.	.	.	.	.	.	.
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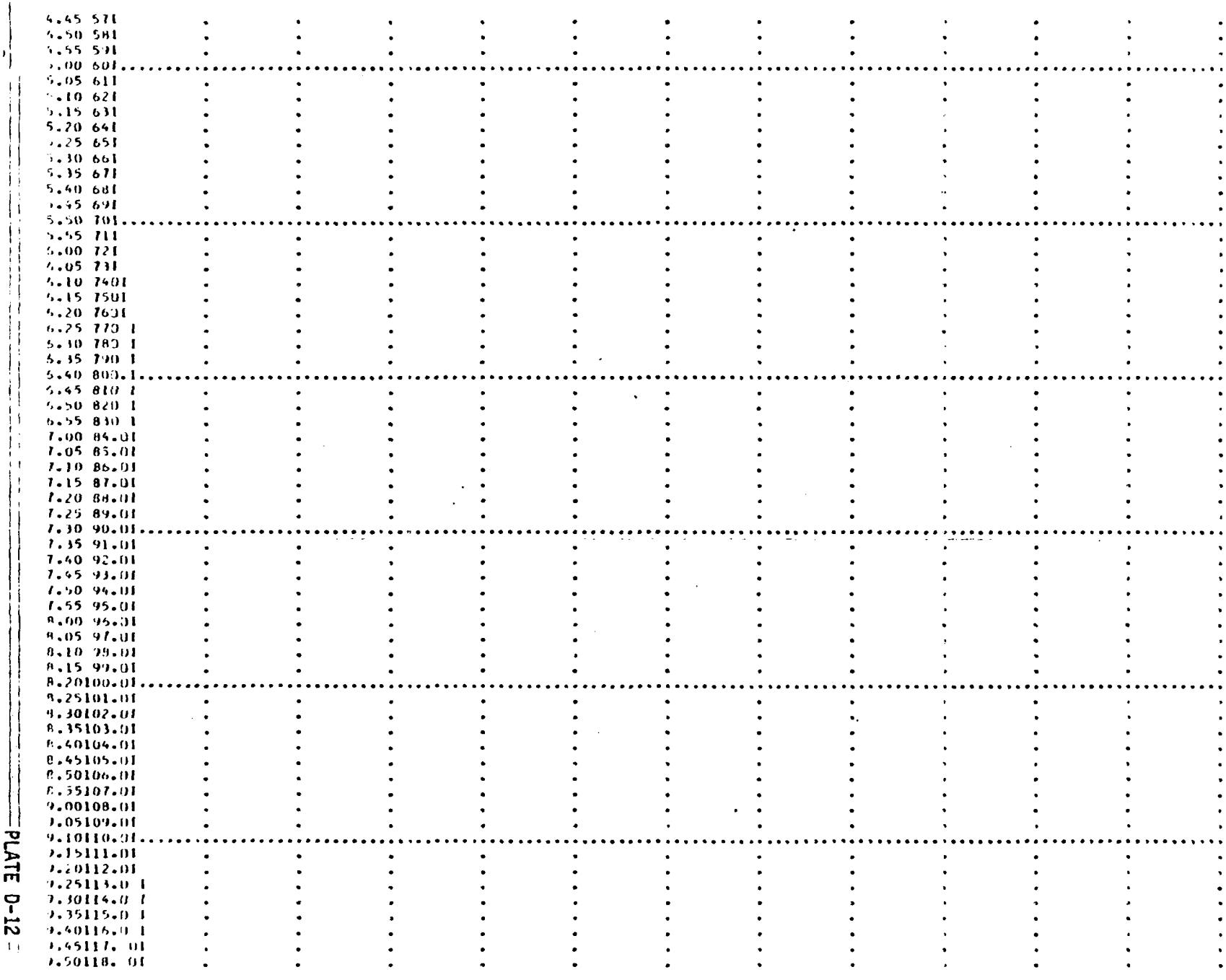
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5.30 66I
5.35 67I
5.40 68I
5.45 69I
5.50 70I
5.55 71I
6.00 72I
6.05 73I
6.10 740I
6.15 750I
6.20 760I
6.25 770 I
6.30 780 I
6.35 790 I
6.40 800.I
6.45 810 I
6.50 820 I
6.55 830 I
7.00 84.0I
7.05 85.0I
7.10 86.0I
7.15 87.0I
7.20 88.0I
7.25 89.0I
7.30 90.0I
7.35 91.0I
7.40 92.0I
7.45 93.0I
7.50 94.0I
7.55 95.0I
8.00 96.0I
8.05 97.0I
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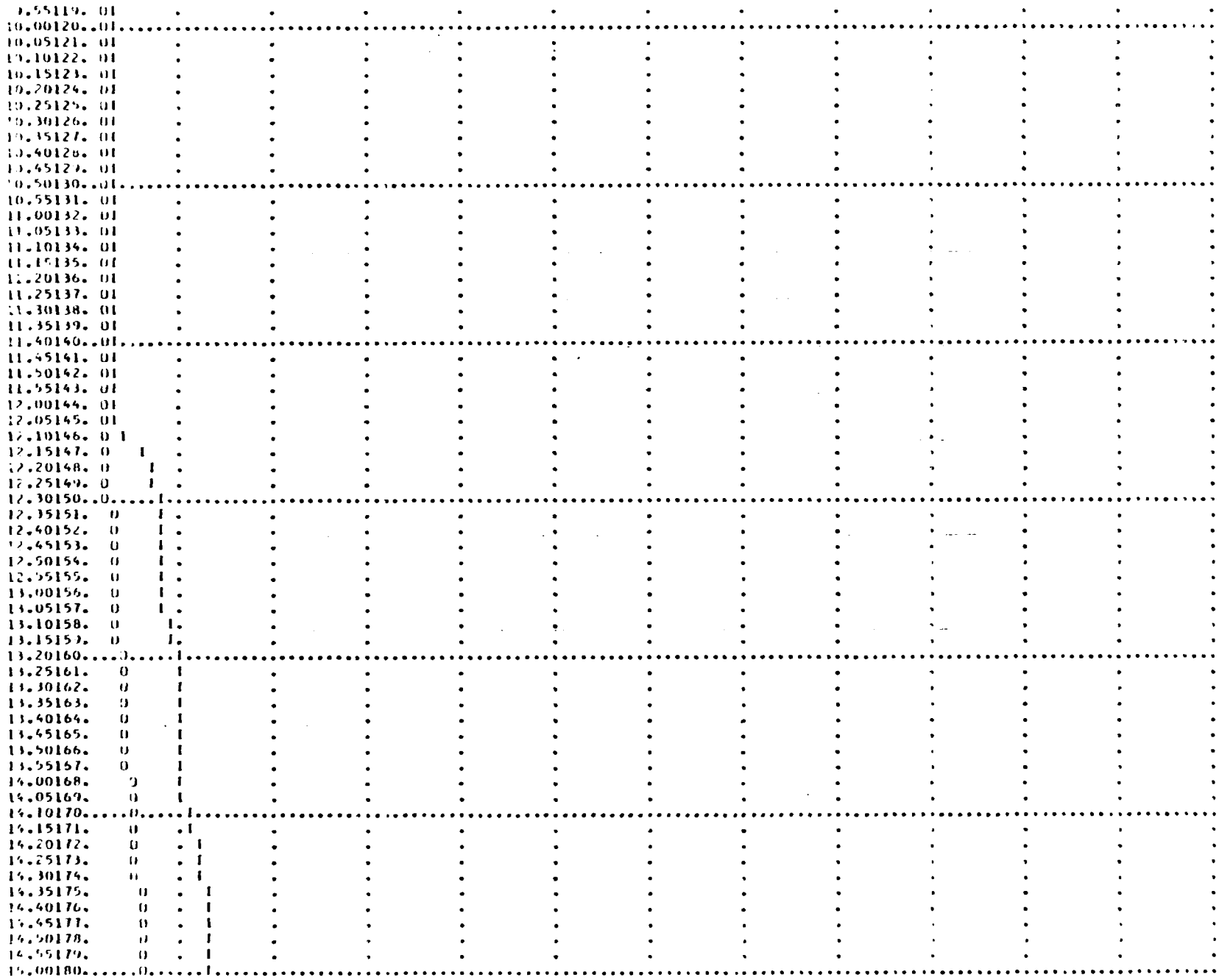
PLATE D-12



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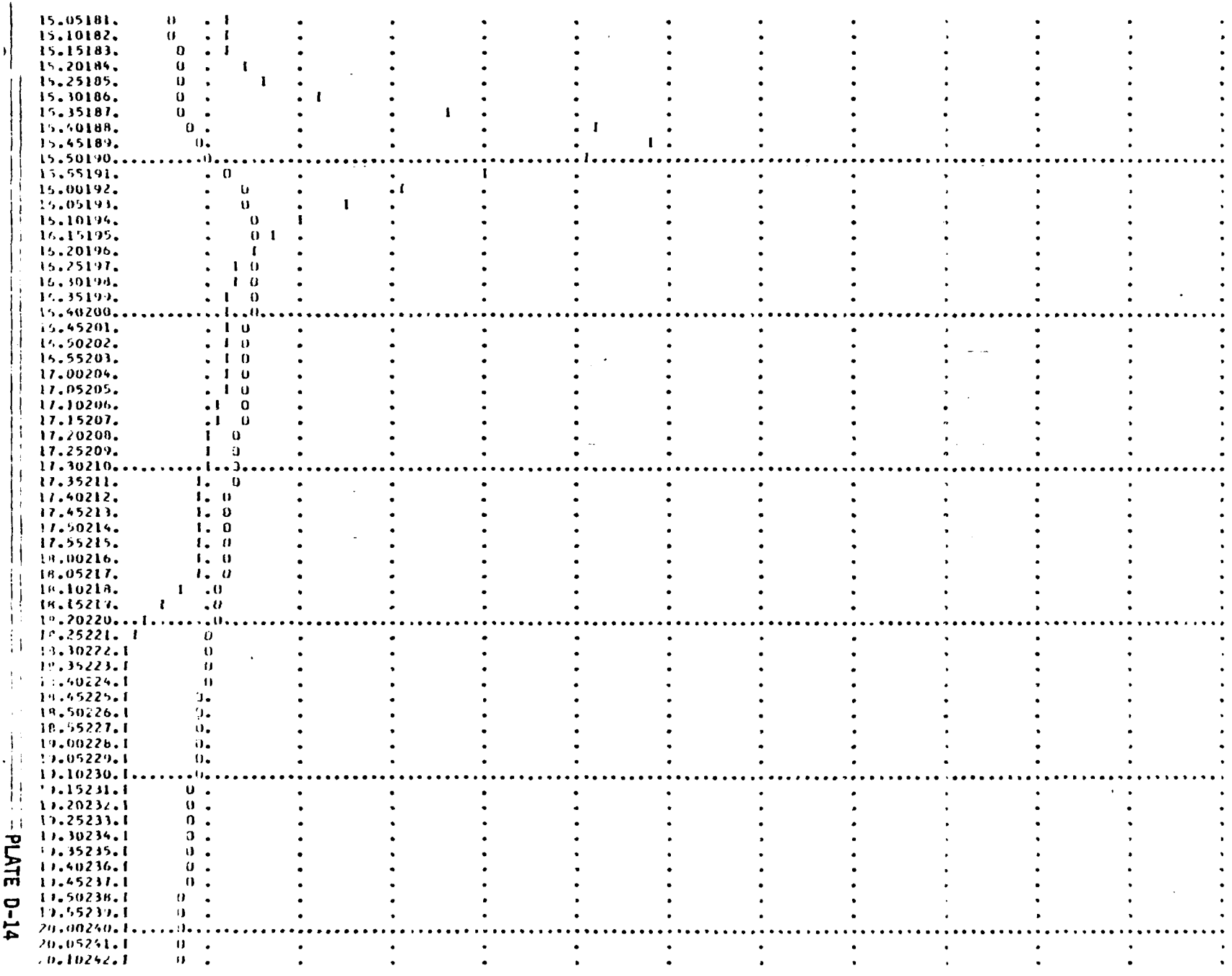
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19.40236.
19.45237.
19.50238.
19.55239.
20.00240.
20.05241.
20.10242.

PLATE D-14

PLATE D-15

IUVN

STATION 000002, PLAN 1, RATIO 8 **0.5 PMF**

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
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1.	1.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	5.	5.	6.	7.	7.	8.	9.
10.	11.	12.	13.	14.	15.	16.	17.	17.	18.
19.	20.	21.	22.	23.	23.	24.	25.	26.	26.
27.	28.	29.	29.	30.	31.	31.	32.	33.	33.
34.	34.	35.	36.	36.	37.	37.	38.	38.	39.
39.	40.	40.	41.	41.	42.	42.	43.	43.	44.
44.	44.	45.	45.	46.	46.	46.	47.	47.	47.
48.	48.	48.	49.	49.	50.	51.	53.	56.	59.
62.	64.	67.	70.	73.	75.	78.	80.	83.	86.
89.	92.	95.	98.	102.	111.	120.	129.	137.	144.
153.	162.	172.	182.	192.	202.	211.	224.	236.	247.
256.	262.	268.	275.	290.	319.	385.	525.	765.	1002.
1062.	984.	864.	750.	654.	580.	528.	485.	451.	423.
401.	384.	369.	358.	348.	338.	327.	317.	306.	296.
288.	280.	273.	268.	263.	259.	254.	246.	233.	216.
201.	188.	177.	166.	156.	148.	140.	132.	125.	118.
112.	106.	100.	99.	97.	96.	94.	93.	92.	90.
89.	88.	86.	85.	84.	82.	81.	80.	79.	78.
77.	76.	74.	73.	72.	71.	70.	69.	68.	67.
66.	65.	64.	64.	63.	62.	61.	60.	59.	58.
58.	57.	56.	55.	55.	54.	53.	52.	52.	51.
50.	50.	49.	49.	48.	47.	47.	46.		

STORAGE

122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	123.	123.	123.	123.	123.	123.	123.	123.	123.
123.	123.	123.	123.	123.	123.	123.	123.	123.	123.
123.	123.	123.	123.	123.	123.	123.	123.	123.	123.
123.	123.	123.	123.	124.	124.	124.	124.	125.	125.
125.	125.	126.	126.	126.	127.	127.	127.	127.	128.
128.	128.	128.	129.	129.	129.	129.	130.	130.	130.
130.	131.	131.	131.	131.	132.	132.	132.	132.	132.
133.	133.	133.	133.	133.	134.	134.	134.	134.	134.
134.	135.	135.	135.	135.	135.	135.	135.	136.	136.
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137.	137.	137.	137.	138.	138.	138.	139.	140.	141.
142.	143.	144.	145.	146.	146.	147.	148.	149.	150.
151.	153.	154.	155.	156.	157.	158.	158.	159.	160.
161.	162.	163.	164.	165.	165.	166.	167.	167.	168.
168.	169.	169.	169.	170.	171.	174.	178.	183.	186.
187.	186.	184.	183.	181.	179.	178.	177.	176.	175.
174.	173.	173.	172.	172.	172.	171.	171.	170.	170.
170.	169.	169.	169.	169.	168.	168.	168.	167.	166.
165.	164.	163.	162.	161.	160.	160.	159.	158.	157.
157.	156.	156.	155.	154.	154.	153.	153.	152.	152.

151.	151.	150.	150.	150.	149.	149.	148.	148.	147.
147.	147.	146.	146.	145.	145.	145.	144.	144.	144.
143.	143.	143.	142.	142.	142.	142.	141.	141.	141.
140.	140.	140.	140.	139.	139.	139.	139.	138.	138.
138.	138.	138.	137.	137.	137.	137.	137.		

STAGE

827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
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827.2	827.2	827.2	827.2	827.2	827.3	827.3	827.3	827.3	827.3
827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3
827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.4
827.4	827.4	827.4	827.4	827.4	827.5	827.5	827.5	827.5	827.5
827.5	827.6	827.6	827.6	827.6	827.6	827.6	827.6	827.7	827.7
827.7	827.7	827.7	827.7	827.7	827.8	827.8	827.8	827.8	827.8
827.8	827.8	827.8	827.8	827.9	827.9	827.9	827.9	827.9	827.9
827.9	827.9	827.9	827.9	827.9	828.0	828.0	828.0	828.0	828.0
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828.3	828.4	828.4	828.5	828.5	828.6	828.6	828.6	828.7	828.7
828.8	828.9	828.9	829.0	829.0	829.1	829.1	829.1	829.2	829.2
829.3	829.3	829.3	829.4	829.4	829.5	829.5	829.5	829.6	829.6
829.6	829.6	829.6	829.6	829.7	829.7	829.8	830.0	830.2	830.4
830.4	830.4	830.3	830.2	830.2	830.1	830.0	830.0	829.9	829.9
829.9	829.8	829.8	829.8	829.8	829.8	829.7	829.7	829.7	829.7
829.7	829.6	829.6	829.6	829.6	829.6	829.6	829.6	829.5	829.5
829.5	829.4	829.4	829.3	829.3	829.2	829.2	829.2	829.1	829.1
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828.2	828.2	828.2	828.2	828.2	828.2	828.2	828.1	828.1	828.1
828.1	828.1	828.1	828.1	828.1	828.1	828.0	828.0		

PEAK OUTFLOW IS 1062. AT TIME 15.92 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1062.	306.	101.	101.	29174.
CMS	30.	9.	3.	3.	826.
INCHES		10.70	14.17	14.17	14.17
MM		271.90	359.92	359.92	359.92
AC-FT		152.	201.	201.	201.
THOUS CU M		187.	248.	248.	248.

DVF

STATION000002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	200.	400.	600.	800.	1000.	1200.	1400.	1600.	0.	0.	0.	0.
.05	11												
.10	21												
.15	31												
.20	41												
.25	51												
.30	61												
.35	71												
.40	81												
.45	91												
.50	101												
.55	111												
1.00	121												
1.05	131												
1.10	141												
1.15	151												
1.20	161												
1.25	171												
1.30	181												
1.35	191												
1.40	201												
1.45	211												
1.50	221												
1.55	231												
2.00	241												
2.05	251												
2.10	261												
2.15	271												
2.20	281												
2.25	291												
2.30	301												
2.35	311												
2.40	321												
2.45	331												
2.50	341												
2.55	351												
3.00	361												
3.05	371												
3.10	381												
3.15	391												
3.20	401												
3.25	411												
3.30	421												
3.35	431												
3.40	441												
3.45	451												
3.50	461												
3.55	471												
4.00	481												
4.05	491												
4.10	501												
4.15	511												
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4.40	561												

PLATE D-18

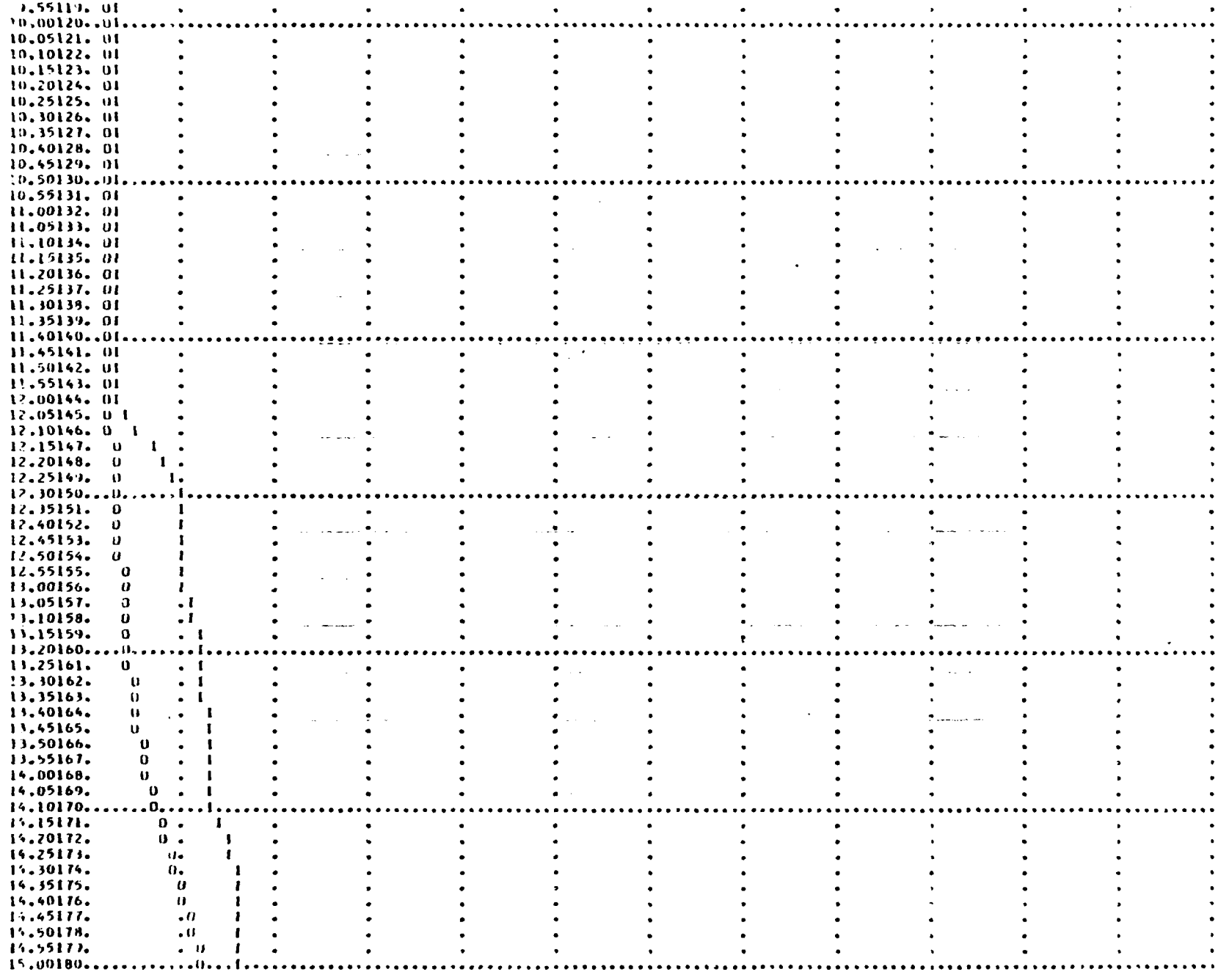
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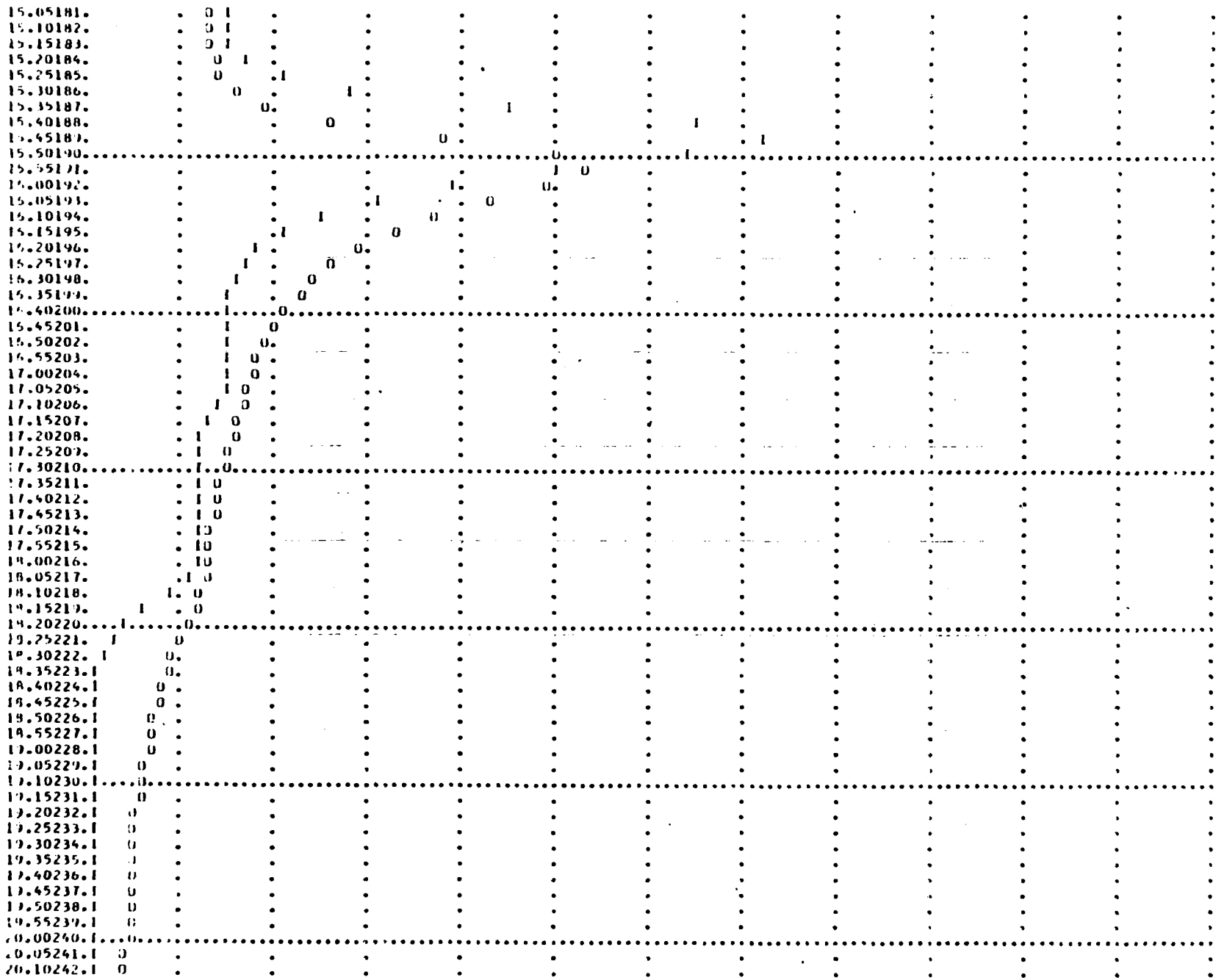
PLATE D-19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16.20196.
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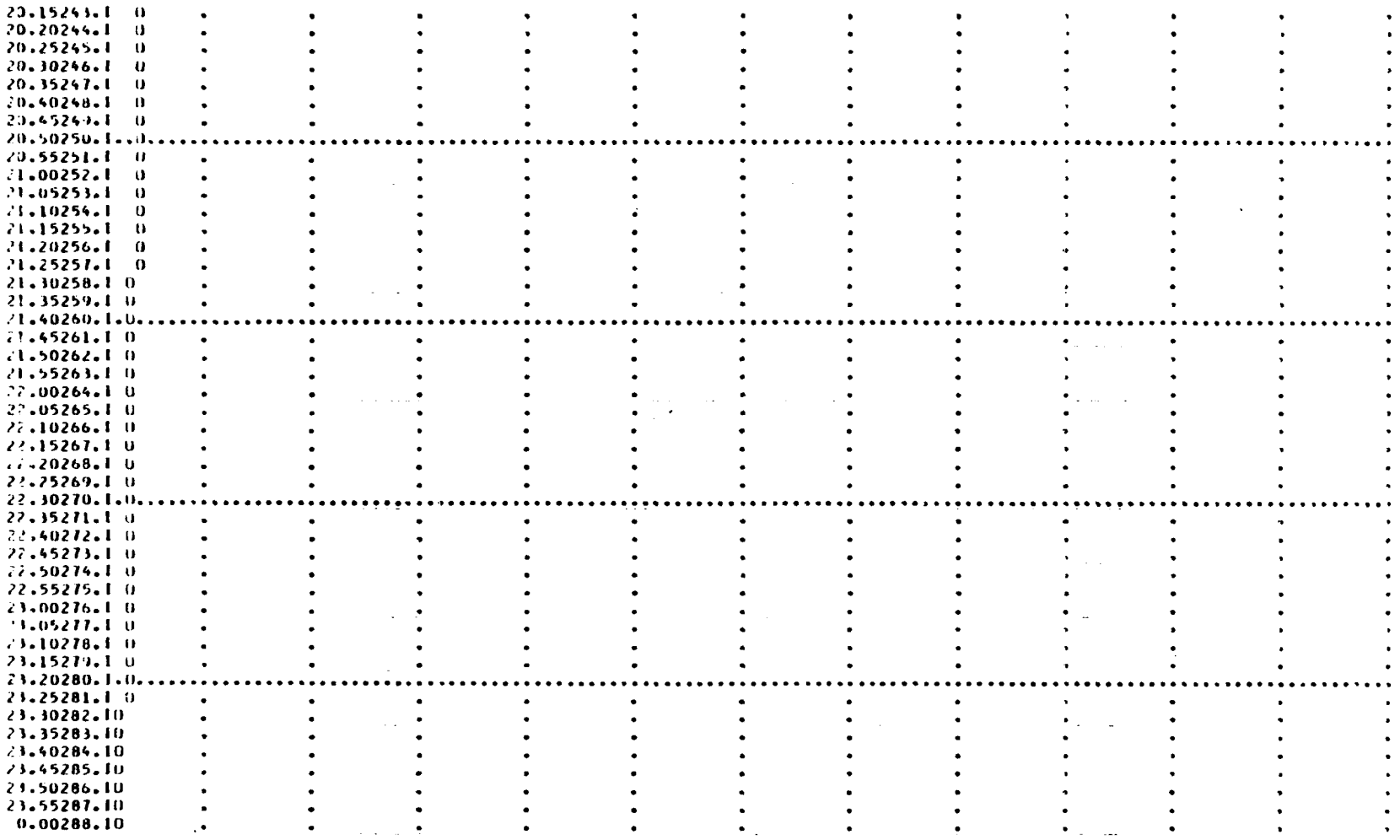
PLATE D-20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22.00264.1 0
22.05265.1 0
22.10266.1 0
22.15267.1 0
22.20268.1 0
22.25269.1 0
22.30270.1 0
22.35271.1 0
22.40272.1 0
22.45273.1 0
22.50274.1 0
22.55275.1 0
23.00276.1 0
23.05277.1 0
23.10278.1 0
23.15279.1 0
23.20280.1 0
23.25281.1 0
23.30282.10
23.35283.10
23.40284.10
23.45285.10
23.50286.10
23.55287.10
0.00288.10

PLATE D-21

.IVN

STATION 000002, PLAN 1, RATIO 9 **PMF**

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	1.	1.
1.	1.	1.	2.	2.	2.	2.	2.	2.	3.
3.	3.	3.	3.	3.	4.	4.	4.	4.	4.
5.	5.	5.	5.	5.	6.	6.	6.	6.	6.
7.	7.	7.	7.	7.	8.	8.	8.	8.	8.
9.	9.	9.	9.	10.	11.	13.	15.	16.	18.
20.	22.	24.	26.	27.	29.	31.	33.	34.	36.
38.	39.	41.	43.	44.	46.	47.	49.	50.	52.
53.	54.	56.	57.	59.	60.	61.	62.	64.	65.
66.	67.	68.	69.	70.	72.	73.	74.	75.	76.
77.	78.	79.	79.	80.	81.	82.	83.	84.	95.
85.	86.	87.	88.	89.	89.	90.	91.	91.	92.
93.	93.	94.	95.	96.	97.	100.	112.	128.	144.
161.	178.	196.	217.	243.	267.	290.	311.	334.	356.
377.	397.	414.	430.	443.	455.	464.	472.	479.	488.
502.	519.	537.	554.	570.	583.	594.	604.	612.	617.
619.	615.	611.	619.	657.	758.	1037.	1632.	2287.	2568.
2372.	2011.	1655.	1361.	1135.	971.	858.	781.	727.	690.
663.	643.	629.	619.	611.	600.	585.	569.	552.	537.
521.	512.	503.	496.	490.	485.	479.	462.	430.	387.
344.	304.	269.	239.	213.	198.	185.	174.	165.	156.
149.	142.	135.	129.	123.	118.	113.	108.	103.	100.
99.	98.	96.	95.	94.	93.	92.	91.	90.	89.
88.	87.	86.	85.	84.	84.	83.	82.	81.	80.
79.	79.	78.	77.	76.	75.	75.	74.	73.	73.
72.	71.	71.	70.	69.	69.	68.	67.	67.	66.
66.	65.	65.	64.	64.	63.	63.	62.		

STORAGE

122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	123.	123.	123.	123.	123.	123.	123.
123.	123.	123.	123.	123.	123.	123.	123.	123.	123.
123.	124.	124.	124.	124.	124.	124.	124.	124.	124.
124.	124.	124.	124.	124.	124.	124.	124.	125.	125.
125.	125.	125.	125.	125.	126.	126.	127.	127.	128.
128.	129.	129.	130.	131.	131.	132.	132.	133.	133.
134.	134.	135.	135.	136.	136.	137.	137.	138.	138.
139.	139.	140.	140.	141.	141.	142.	142.	142.	143.
143.	144.	144.	144.	145.	145.	146.	146.	146.	147.
147.	147.	148.	148.	148.	149.	149.	149.	150.	150.
150.	150.	151.	151.	151.	152.	152.	152.	152.	153.
153.	153.	153.	154.	154.	154.	155.	157.	158.	160.
162.	163.	165.	166.	168.	169.	170.	171.	172.	172.
173.	174.	175.	175.	176.	176.	176.	176.	177.	177.
177.	178.	178.	179.	179.	180.	180.	180.	180.	180.
180.	180.	180.	180.	181.	183.	187.	193.	198.	200.
199.	196.	193.	190.	188.	186.	184.	183.	182.	182.
181.	181.	181.	180.	180.	180.	180.	179.	179.	178.
178.	178.	177.	177.	177.	177.	177.	176.	175.	174.
172.	170.	169.	167.	166.	165.	164.	163.	162.	161.
161.	160.	159.	158.	158.	157.	157.	156.	156.	155.

PLATE D-22

155.	155.	154.	154.	153.	153.	153.	152.	152.	151.
151.	151.	150.	150.	150.	149.	149.	149.	149.	148.
148.	148.	147.	147.	147.	147.	146.	146.	146.	146.
145.	145.	145.	145.	144.	144.	144.	144.	144.	143.
143.	143.	143.	143.	142.	142.	142.	142.		

STAGE

827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2	827.2
827.2	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3
827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3
827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3	827.3
827.4	827.4	827.4	827.4	827.4	827.4	827.4	827.5	827.5	827.5
827.6	827.6	827.6	827.7	827.7	827.7	827.8	827.8	827.8	827.8
827.9	827.9	827.9	828.0	828.0	828.0	828.1	828.1	828.1	828.1
828.2	828.2	828.2	828.2	828.3	828.3	828.3	828.3	828.3	828.4
828.4	828.4	828.4	828.4	828.5	828.5	828.5	828.5	828.5	828.6
828.6	828.6	828.6	828.6	828.6	828.7	828.7	828.7	828.7	828.7
828.7	828.8	828.8	828.8	828.8	828.8	828.8	828.8	828.8	828.9
828.9	828.9	828.9	828.9	828.9	828.9	829.0	829.1	829.1	829.2
829.3	829.4	829.4	829.5	829.6	829.6	829.7	829.7	829.7	829.8
829.8	829.9	829.9	829.9	829.9	829.9	829.9	830.0	830.0	830.0
830.0	830.0	830.0	830.1	830.1	830.1	830.1	830.1	830.1	830.1
830.1	830.1	830.1	830.1	830.2	830.2	830.4	830.6	830.9	830.9
830.9	830.8	830.6	830.5	830.4	830.4	830.3	830.3	830.2	830.2
830.2	830.1	830.1	830.1	830.1	830.1	830.1	830.1	830.1	830.0
830.0	830.0	830.0	830.0	830.0	830.0	830.0	829.9	829.9	829.8
829.8	829.7	829.6	829.6	829.5	829.5	829.4	829.4	829.3	829.3
829.2	829.2	829.2	829.1	829.1	829.1	829.1	829.0	829.0	829.0
829.0	829.0	828.9	828.9	828.9	828.9	828.9	828.8	828.8	828.8
828.8	828.8	828.8	828.7	828.7	828.7	828.7	828.7	828.7	828.6
828.6	828.6	828.6	828.6	828.6	828.6	828.5	828.5	828.5	828.5
828.5	828.5	828.5	828.5	828.4	828.4	828.4	828.4	828.4	828.4
828.4	828.4	828.4	828.4	828.3	828.3	828.3	828.3		

PEAK OUTFLOW IS 2568. AT TIME 15.83 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2568.	670.	207.	207.	59667.
CMS	73.	19.	6.	6.	1690.
INCHES		23.43	28.98	28.98	28.98
MM		595.04	736.11	736.11	736.11
AC-FT		332.	411.	411.	411.
THOUS CU M		410.	507.	507.	507.

OVF

STATION0000002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	400.	800.	1200.	1600.	2000.	2400.	2800.	3200.	0.	0.	0.	0.
.05	1I	.	.	.	.	.	.	.	.	.	.	.	.
.10	2I	.	.	.	.	.	.	.	.	.	.	.	.
.15	3I	.	.	.	.	.	.	.	.	.	.	.	.
.20	4I	.	.	.	.	.	.	.	.	.	.	.	.
.25	5I	.	.	.	.	.	.	.	.	.	.	.	.
.30	6I	.	.	.	.	.	.	.	.	.	.	.	.
.35	7I	.	.	.	.	.	.	.	.	.	.	.	.
.40	8I	.	.	.	.	.	.	.	.	.	.	.	.
.45	9I	.	.	.	.	.	.	.	.	.	.	.	.
.50	10I	.	.	.	.	.	.	.	.	.	.	.	.
.55	11I	.	.	.	.	.	.	.	.	.	.	.	.
1.00	12I	.	.	.	.	.	.	.	.	.	.	.	.
1.05	13I	.	.	.	.	.	.	.	.	.	.	.	.
1.10	14I	.	.	.	.	.	.	.	.	.	.	.	.
1.15	15I	.	.	.	.	.	.	.	.	.	.	.	.
1.20	16I	.	.	.	.	.	.	.	.	.	.	.	.
1.25	17I	.	.	.	.	.	.	.	.	.	.	.	.
1.30	18I	.	.	.	.	.	.	.	.	.	.	.	.
1.35	19I	.	.	.	.	.	.	.	.	.	.	.	.
1.40	20I	.	.	.	.	.	.	.	.	.	.	.	.
1.45	21I	.	.	.	.	.	.	.	.	.	.	.	.
1.50	22I	.	.	.	.	.	.	.	.	.	.	.	.
1.55	23I	.	.	.	.	.	.	.	.	.	.	.	.
2.00	24I	.	.	.	.	.	.	.	.	.	.	.	.
2.05	25I	.	.	.	.	.	.	.	.	.	.	.	.
2.10	26I	.	.	.	.	.	.	.	.	.	.	.	.
2.15	27I	.	.	.	.	.	.	.	.	.	.	.	.
2.20	28I	.	.	.	.	.	.	.	.	.	.	.	.
2.25	29I	.	.	.	.	.	.	.	.	.	.	.	.
2.30	30I	.	.	.	.	.	.	.	.	.	.	.	.
2.35	31I	.	.	.	.	.	.	.	.	.	.	.	.
2.40	32I	.	.	.	.	.	.	.	.	.	.	.	.
2.45	33I	.	.	.	.	.	.	.	.	.	.	.	.
2.50	34I	.	.	.	.	.	.	.	.	.	.	.	.
2.55	35I	.	.	.	.	.	.	.	.	.	.	.	.
3.00	36I	.	.	.	.	.	.	.	.	.	.	.	.
3.05	37I	.	.	.	.	.	.	.	.	.	.	.	.
3.10	38I	.	.	.	.	.	.	.	.	.	.	.	.
3.15	39I	.	.	.	.	.	.	.	.	.	.	.	.
3.20	40I	.	.	.	.	.	.	.	.	.	.	.	.
3.25	41I	.	.	.	.	.	.	.	.	.	.	.	.
3.30	42I	.	.	.	.	.	.	.	.	.	.	.	.
3.35	43I	.	.	.	.	.	.	.	.	.	.	.	.
3.40	44I	.	.	.	.	.	.	.	.	.	.	.	.
3.45	45I	.	.	.	.	.	.	.	.	.	.	.	.
3.50	46I	.	.	.	.	.	.	.	.	.	.	.	.
3.55	47I	.	.	.	.	.	.	.	.	.	.	.	.
4.00	48I	.	.	.	.	.	.	.	.	.	.	.	.
4.05	49I	.	.	.	.	.	.	.	.	.	.	.	.
4.10	50I	.	.	.	.	.	.	.	.	.	.	.	.
4.15	51I	.	.	.	.	.	.	.	.	.	.	.	.
4.20	52I	.	.	.	.	.	.	.	.	.	.	.	.
4.25	53I	.	.	.	.	.	.	.	.	.	.	.	.
4.30	54I	.	.	.	.	.	.	.	.	.	.	.	.
4.35	55I	.	.	.	.	.	.	.	.	.	.	.	.
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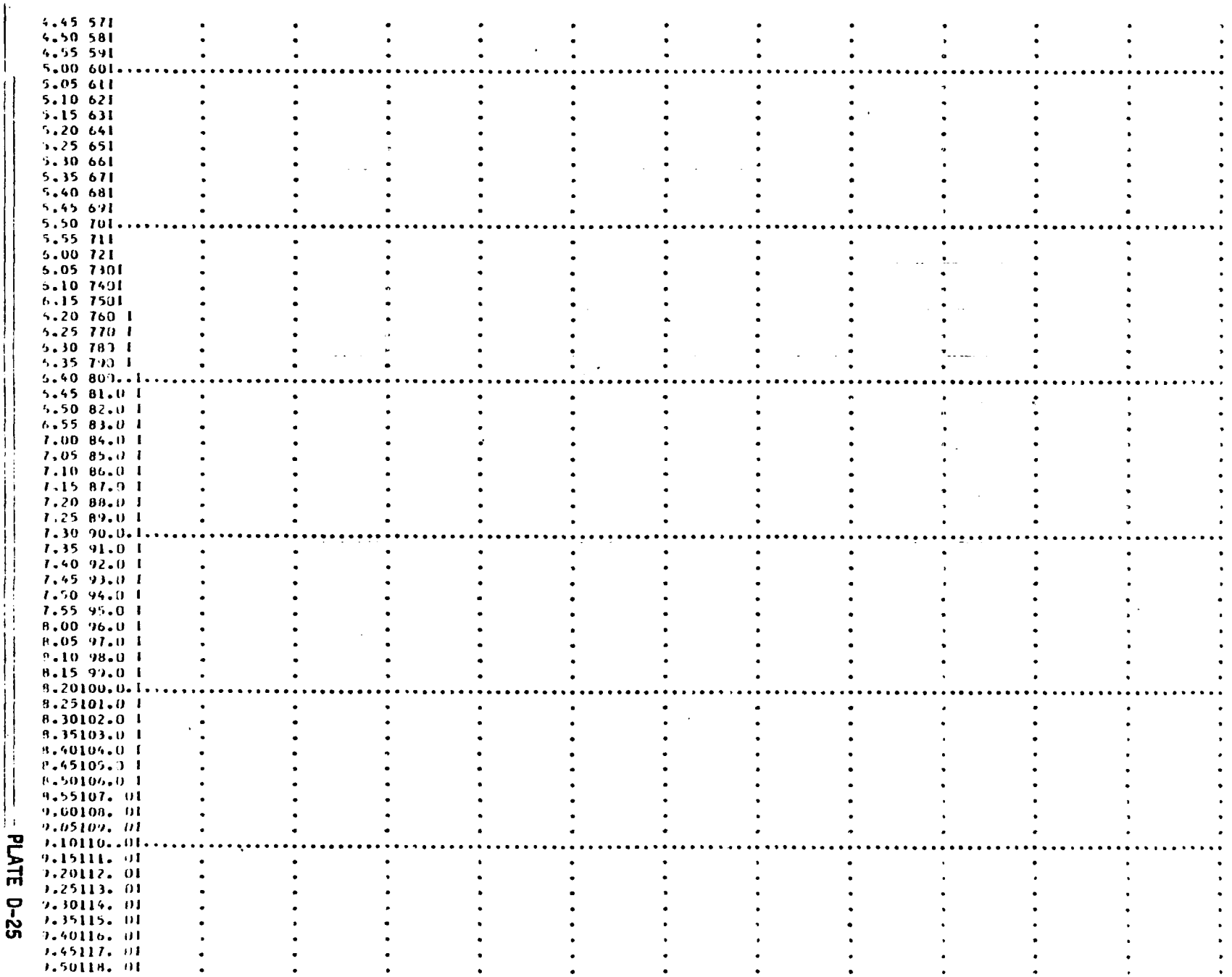
PLATE D-24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5.30 66I
5.35 67I
5.40 68I
5.45 69I
5.50 70I
5.55 71I
6.00 72I
6.05 730I
6.10 740I
6.15 750I
6.20 760 I
6.25 770 I
6.30 780 I
6.35 790 I
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6.50 82.0 I
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7.00 84.0 I
7.05 85.0 I
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PLATE D-25

PLATE D-26

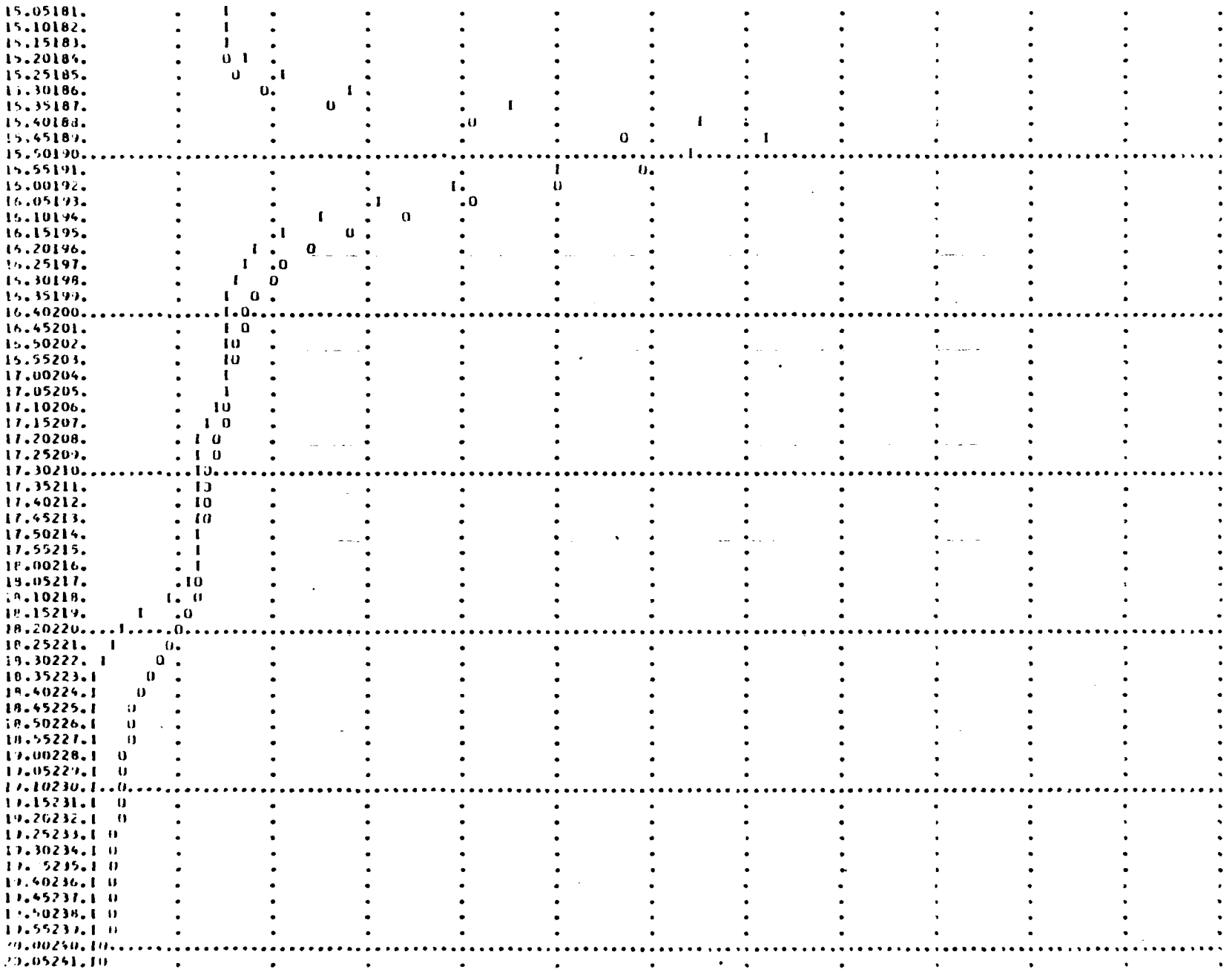
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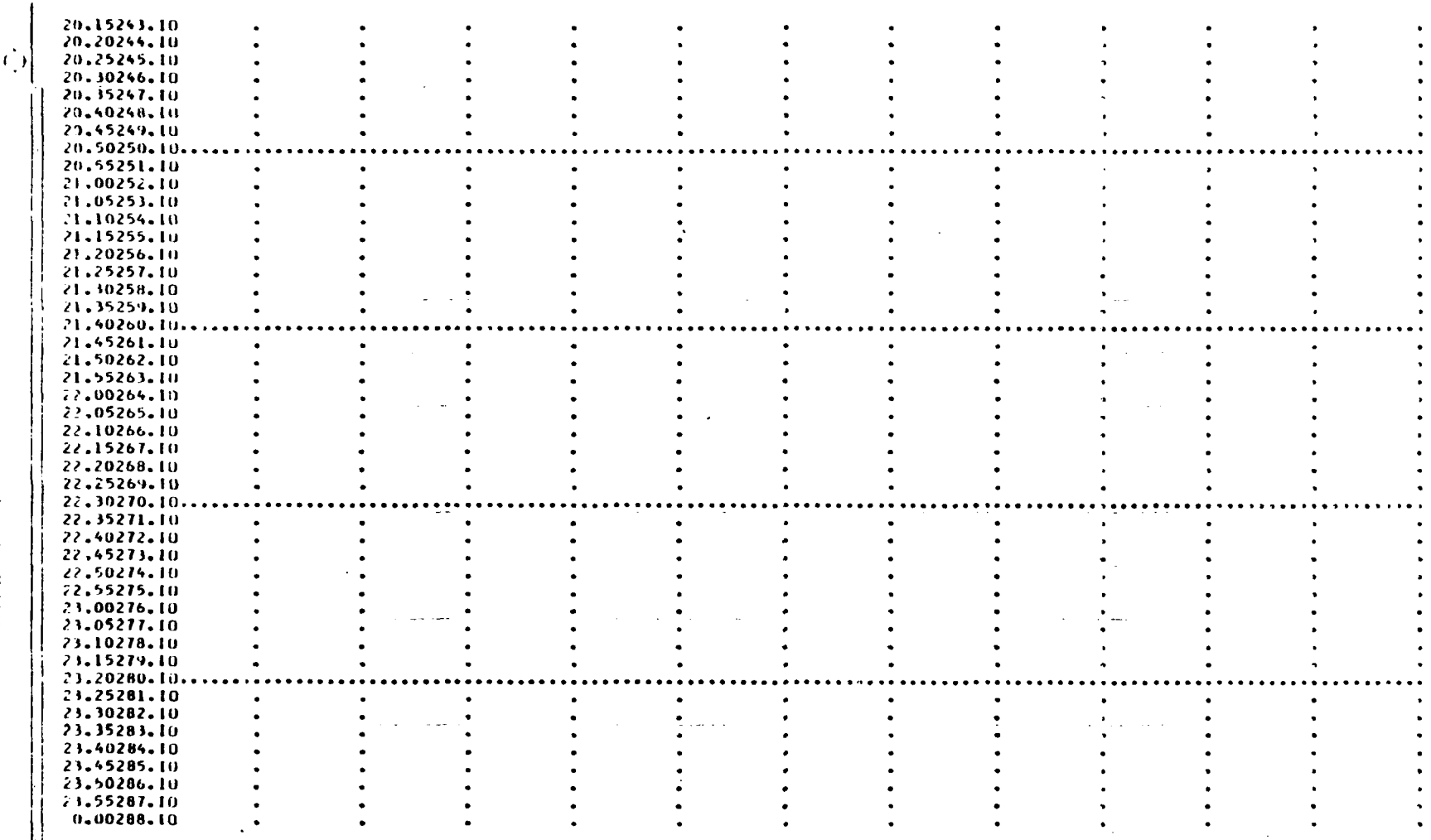
PLATE D-27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23.05277.10
23.10278.10
23.15279.10
23.20280.10
23.25281.10
23.30282.10
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23.50286.10
23.55287.10
0.00288.10

PLATE D-28

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .05	RATIO 2 .10	RATIO 3 .15	RATIO 4 .20	RATIO 5 .25	RATIO 6 .30	RATIO 7 .35	RATIO 8 .50	RATIO 9 1.00
HYDROGRAPH AT	000001	.27	1	144.	288.	432.	576.	720.	863.	1007.	1439.	2878.
		(.69)		(4.08)	(8.15)	(12.23)	(16.30)	(20.38)	(24.45)	(28.53)	(40.75)	(81.51)
ROUTED TO	000002	.27	1	32.	62.	90.	151.	256.	399.	550.	1062.	2568.
		(.69)		(.89)	(1.74)	(2.56)	(4.29)	(7.24)	(11.31)	(15.57)	(30.08)	(72.73)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	827.20	827.20	829.20
STORAGE	122.	122.	160.
OUTFLOW	0.	0.	140.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	827.77	0.00	132.	32.	0.00	16.50	0.00
.10	828.31	0.00	142.	62.	0.00	16.58	0.00
.15	828.83	0.00	152.	90.	0.00	16.67	0.00
.20	829.26	.06	161.	151.	1.00	16.33	0.00
.25	829.60	.40	168.	256.	2.58	16.17	0.00
.30	829.85	.65	174.	399.	2.92	16.08	0.00
.35	830.06	.86	179.	550.	3.25	16.00	0.00
.50	830.41	1.21	187.	1062.	4.75	15.92	0.00
1.00	830.94	1.74	200.	2566.	6.92	15.83	0.00